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telecommunication journal

MONTHLY MAGAZINE OF THE INTERNATIONAL
TELECOMMUNICATION UNION — MAY 1980

INTERNATIONAL CAPABILITIES

NEAX 61. The digita

NEAX 61 Local Switch
Covers 500 to 100,000 lines as a local switching system with a maximum of 27,000 erlangs (972,000 CCS) and 700,000 BHCA.

NEAX 61 Toll Switch
Covers up to 60,000 trunks as a toll switching system with a maximum of 27,000 erlangs (972,000 CCS) and 700,000 BHCA.

NEAX 61 Remote Switch
Covers up to 2,000 lines with an emergency call facility within a radius of 80 kilometers (50 miles) from the Central Office.

NEAX 61 Mobile Telephone Switch
Covers 100,000 subscribers as a mobile telephone switching system with a maximum of 27,000 erlangs (972,000 CCS) and 700,000 BHCA.

NEAX 61 International Switch
Covers up to 30,000 international circuits with a maximum of 27,000 erlangs (972,000 CCS) and 700,000 BHCA.

PLUS REMOTE POSSIBILITIES
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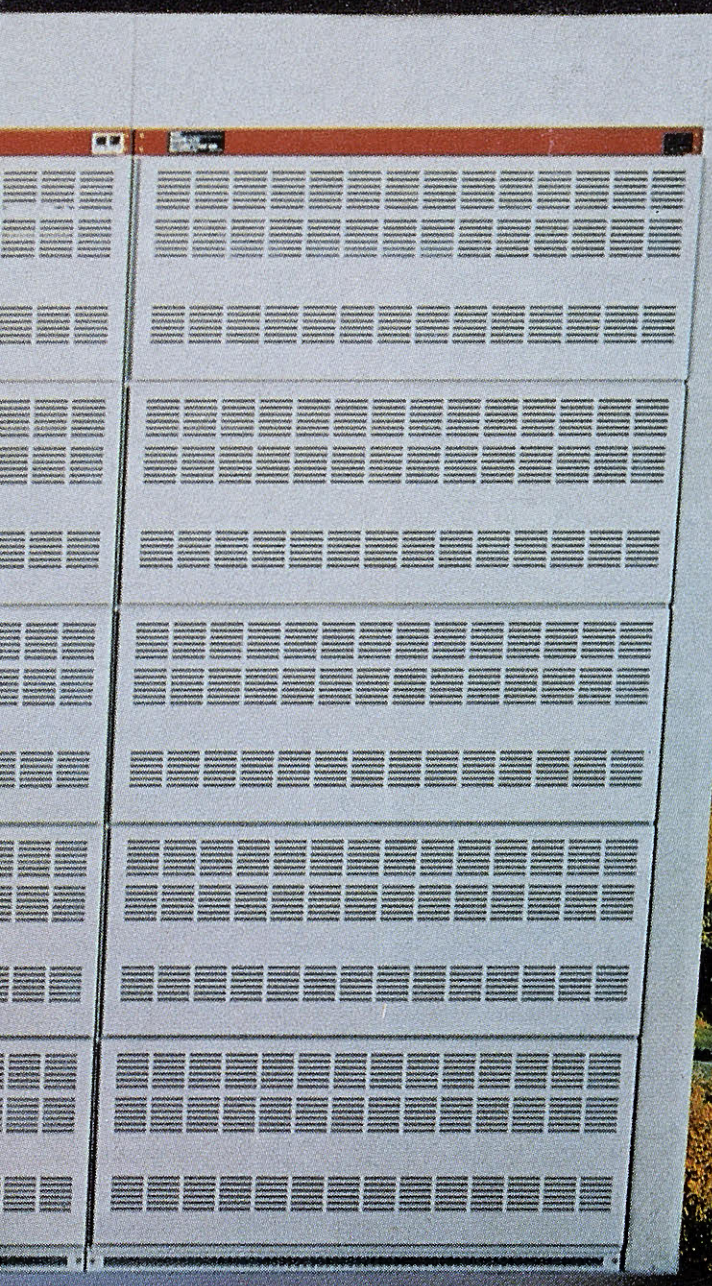

When a telephone company or a post and telecommunications authority is in the market for a digital switching system, one of the first things that captures its attention is the incredibly wide application range of the NEAX 61 from NEC. Not only can it serve as a large capacity toll or local switching system for a metropolitan office, or a smaller one to serve a medium-sized community, it can also act as a remote office for an isolated subscriber area, a mobile telephone network for vehicle-bound subscribers and even as an international switching system.

But its versatility is not all that attracts potential buyers. Other key features that have helped us develop an impressive list of satisfied customers are the NEAX 61's ability to handle up to 27,000 erlangs in a single system, or when serving as a local switch, anywhere from 500 to 100,000 lines. And that's only part of the NEAX 61's incredible story. If you delve deeper you'll see that the possibilities are practically endless. Contact your nearest NEC representative. He'll be totally qualified to answer any questions you may have regarding this unique digital switching system.

TIME MACHINE NEAX 61

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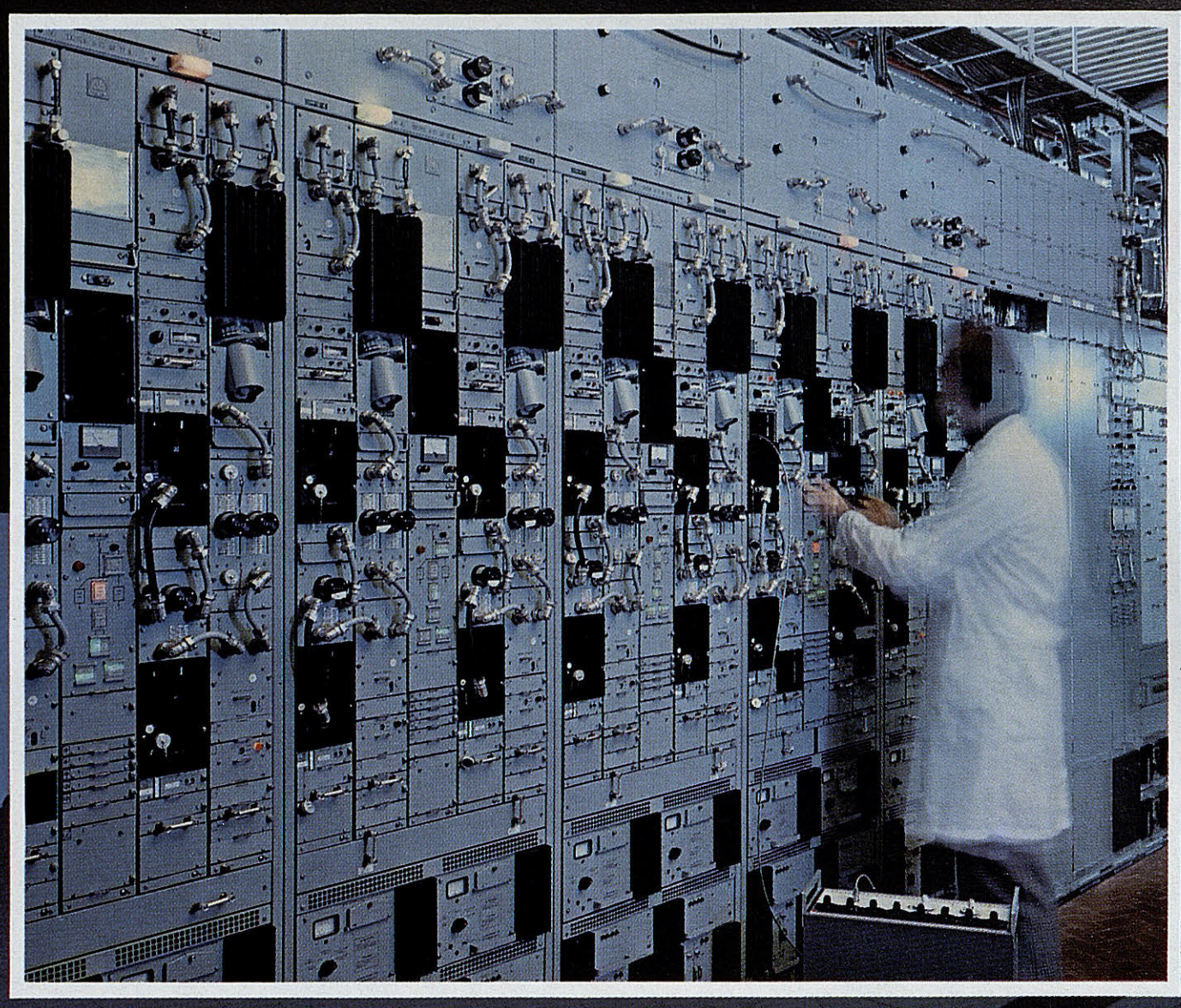
Nippon Electric Co., Ltd.
Tokyo, Japan



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Argentina is a modern country. And yet it has its vast solitary stretches of land, where for days one may meet the occasional rider.
Here too communication is a problem, an essential attribute of progress; Radio Global will overcome the obstacle of distant solitude.
Empresa National de Telecommunicationes has launched a project and awarded a contract to a Consortium led by Telettra Argentina for the supply of a microwave radio system.
The contract includes the supply of 1,200 transceivers with 300 to 1,800 channel capacity, operating in the 2,4,6 and 7 GHz bands, with associated service multiplex and supervisory telecontrol equipment.
The radio network will bring telephone and television services to the remotest areas of the country, under the most different and severe environmental conditions.
This is a turn-key project.

Telettra designs, constructs and installs complete systems for telephone transmissions and switching, for television and data transmission, for telecontrol and monitoring.
An outstanding Telettra feature is the capability of solving unconventional TLC problems.

telettra

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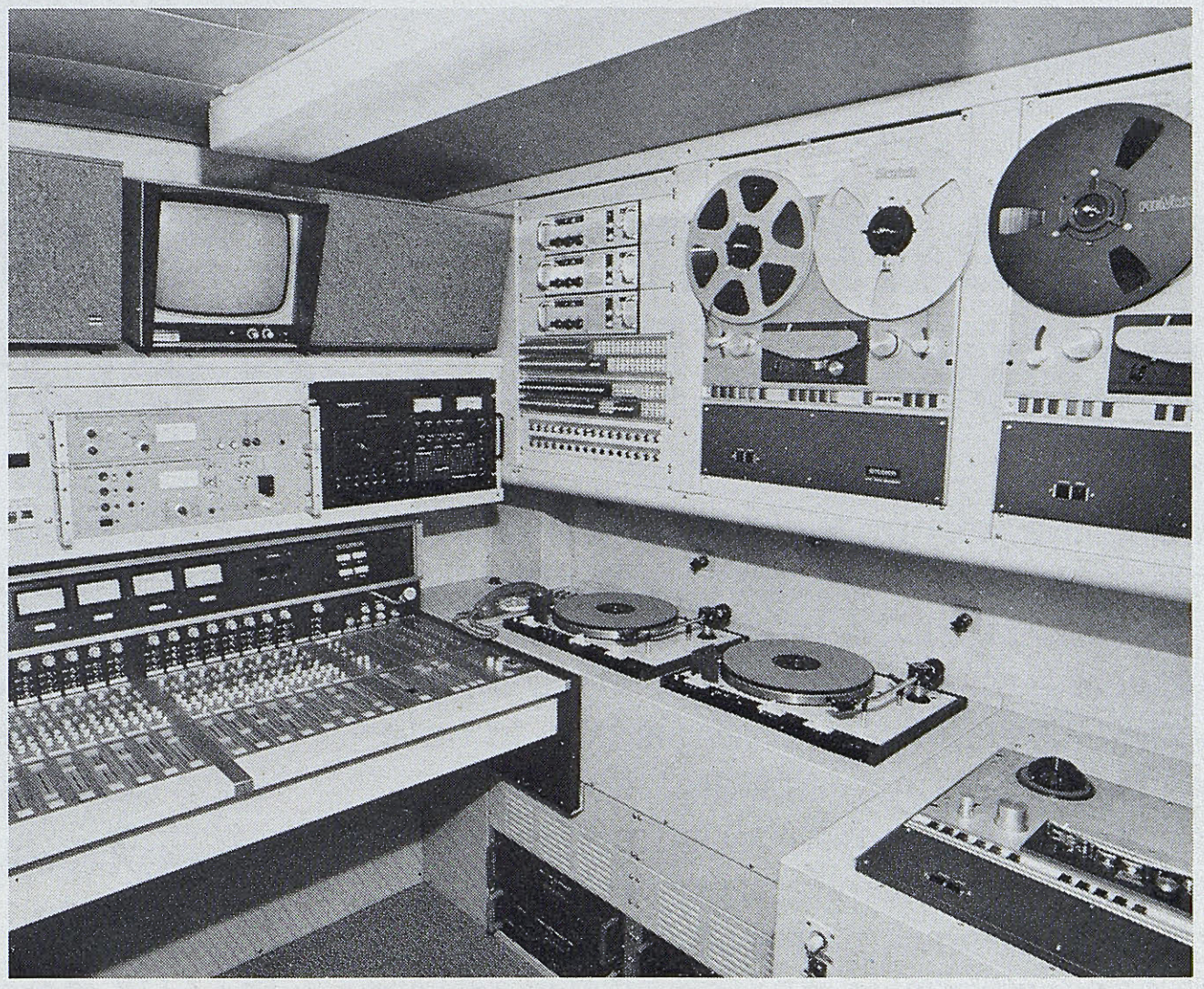
We have more than a quarter of a century's experience in studio techniques. That is why our services are so up to date.

689 STR

What counts in the studio systems business is the ability to meet the requirements of a project quickly, flexibly and reliably, for the problems involved here are so specific that off-the-shelf solutions are impossible. Only a systems specialist with long years of successful experience in providing the right answers fast can hope to keep up to date.

For over 25 years STR has kept pace with progress in all sectors of stationary and mobile studio equipment. During that time our broad scope of activities has helped us acquire really comprehensive know-how. Whether we use our own or other products, we can guarantee that our solution to the problem will be the best – objectively. That means not only up-to-the-minute technology but also total functional reliability and maximum rationalization for real profitability – exactly what you would expect from a Swiss company. And it is after all not just a coincidence that we installed Swiss Television's three national studios and also all the major radio studios in Switzerland.

In other words STR is probably the company you should be talking to if you are thinking seriously about studio systems. Why not get in touch with us?



STR services include:

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- engineering
- manufacture
- inspection and site survey
- advice to the architect
- delivery to site
- erection
- installation
- commissioning
- testing
- training
- maintenance

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Friesenbergstrasse 75

Dr. Juchli

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SIEMENS

Communications will grow – so will EDX and EDS

Computer-controlled, all-electronic switching systems are replacing the electromechanical exchanges in the sphere of telex and data communications all over the world. One major problem is how to determine the optimum size and flexibility necessary for tomorrow's communications systems. A system is needed which can grow as operation demand increases, but doesn't involve too high initial investment.

EDX and EDS establish circuit, packet and store-and-forward switches

Of modular design, the Siemens EDX system family and Siemens System EDS are eminently suitable for establishing circuit and store-and-forward message switches. EDX also allows packet switching centers to be implemented.

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In the EDX circuit switching exchange, each switching block has a capacity of 4,032 subscriber and trunk lines, connected in any combination, with a throughput rate of approximately 400,000 characters/second. Several switching blocks can be interconnected. This concept makes it possible to establish exchanges ranging in size from those with just a few hundred line terminations to those of any required number. Moreover, implementation can be in cost-effective stages.

The EDX packet switching center can handle up to 1,000 packets/second.

The EDX store-and-forward message switch has a memory capacity adequate for any application. Several hundred line terminations can be provided, the actual number depending on traffic density.

EDS for large exchanges

With its addressing capacity of 28,000 lines, EDS is capable of transmitting 1,4 Mbit/s on a bit-by-bit basis, and as many as 7 Mbit/s with bit-group switching. Its particularly high call handling capability allows to complete up to 100 calls per second. As with EDX, the system can be expanded in modular stages.

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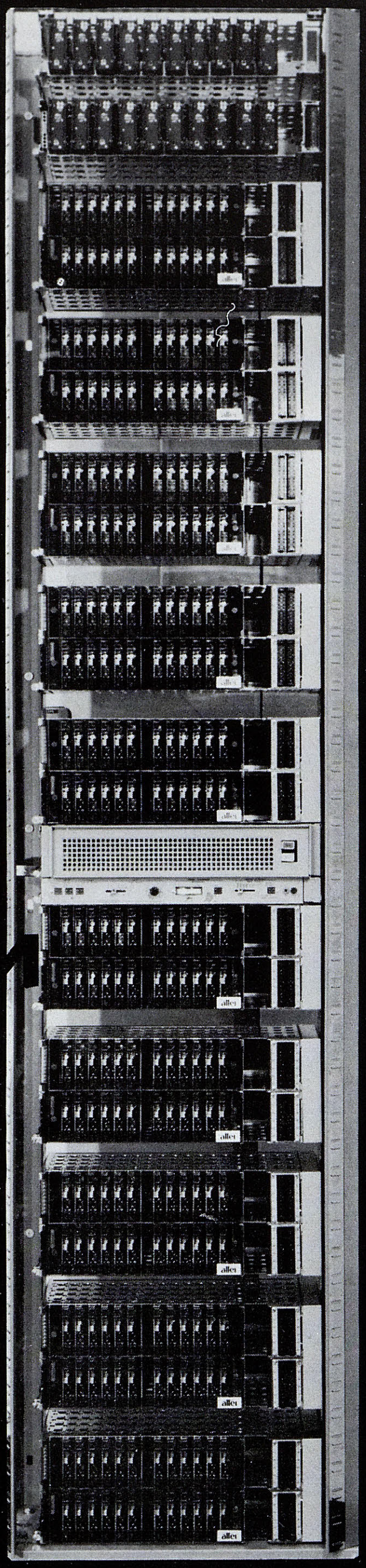

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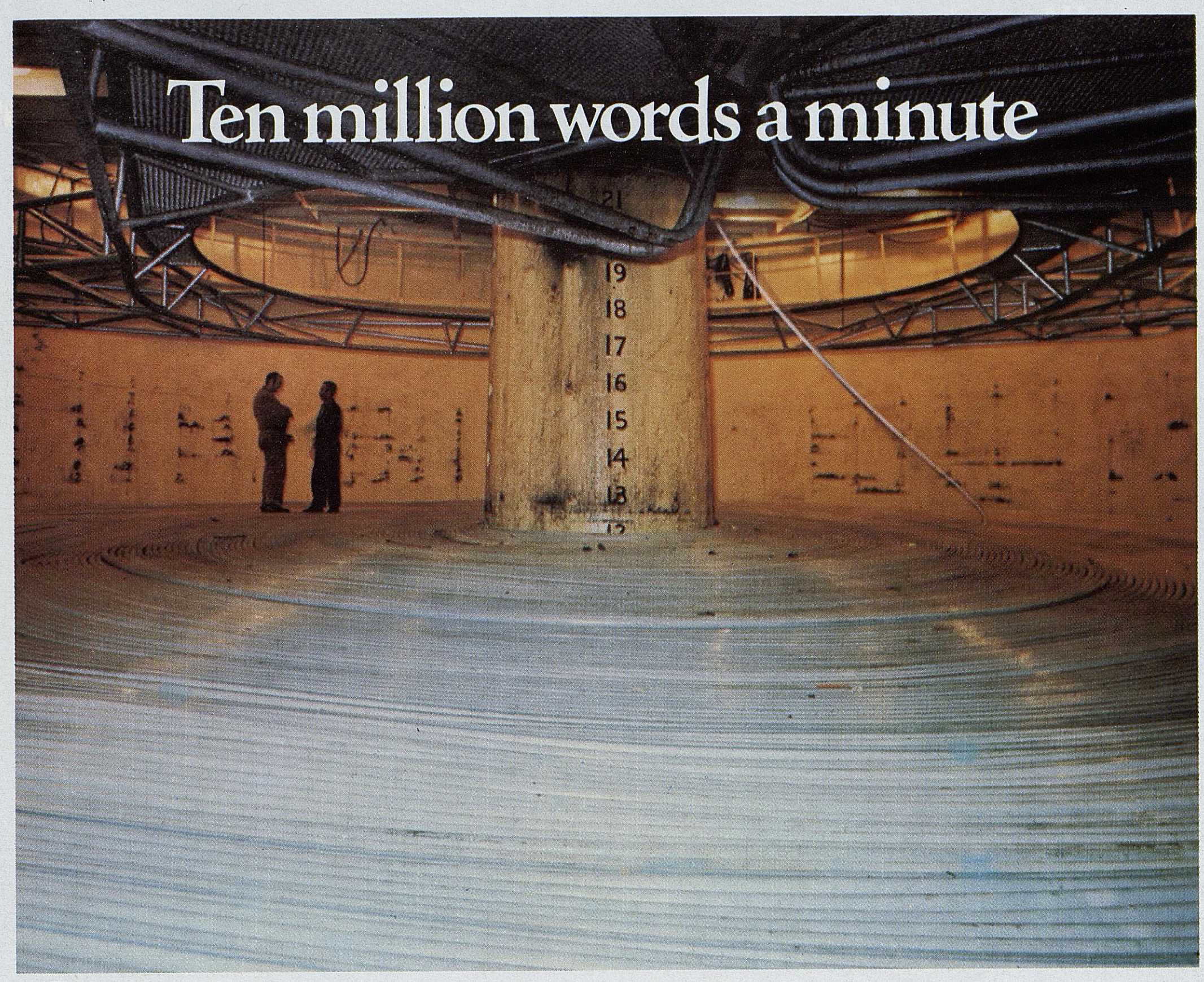
Ten million words a minute



When we pioneered the global telegraph cable business over a century ago it would have taken two years non-stop to transmit ten million words.

Now, with the latest high-capacity telephone cables linked to high-speed data systems, we could do it in one minute.

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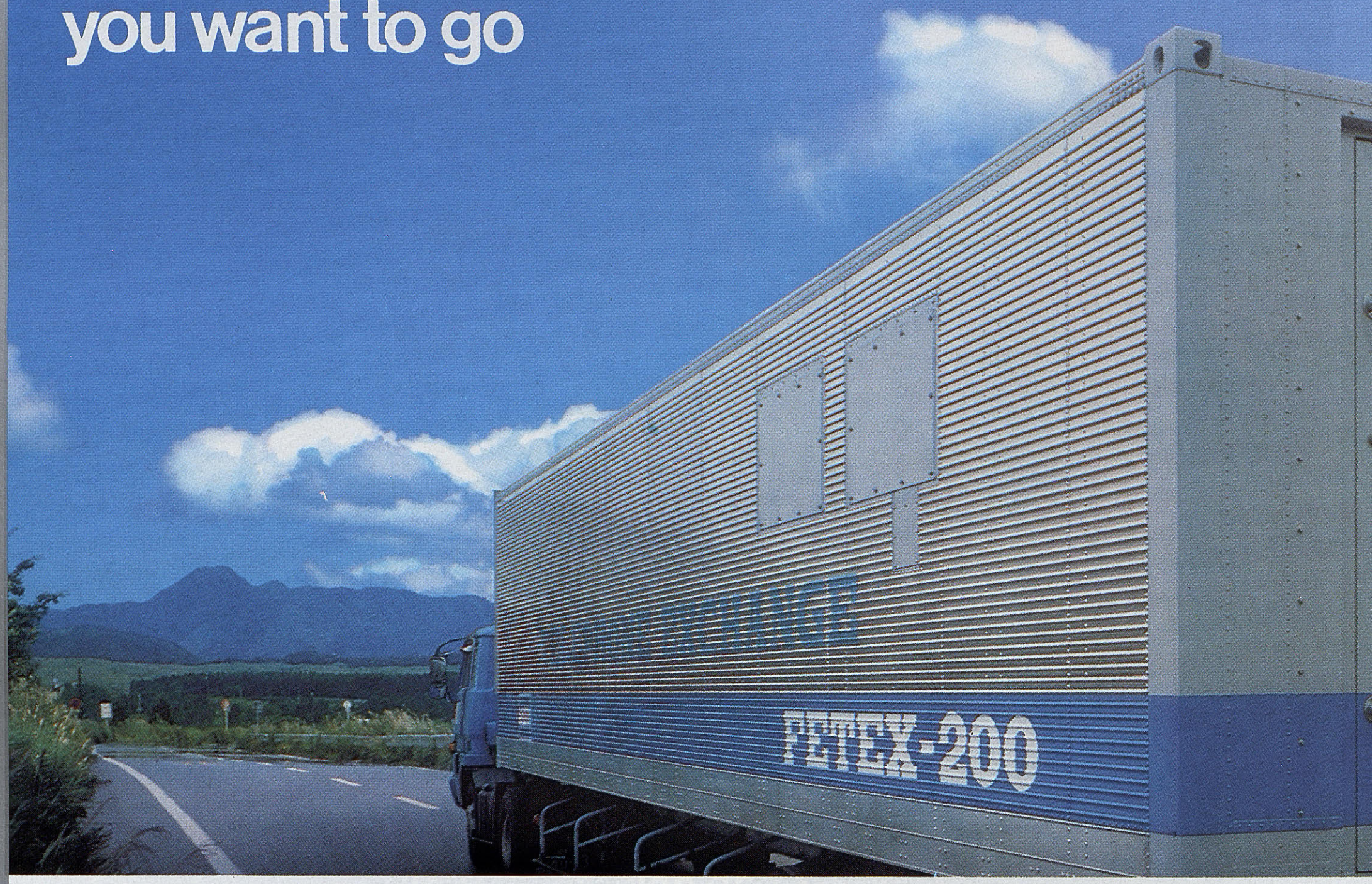
Fujitsu brings you the FETEX Mobile Electronic Switching that'll take you as far as you want to go



Fujitsu developed the FETEX-200 mobile electronic switching system to bring greater versatility, reliability and mobility to your communications network. It is the answer to your present and future needs for as far as you want to go.

Quick installation anywhere

The FETEX-200 is a mobile container type exchange that can withstand low-temperature, high-temperature or high-temperature/humidity conditions. And since it does not require a building, it is ready for immediate service after a few simple connections.

Easy and economical expansion

With a capacity of up to 18,000 lines, it is designed for easy and economical expansion which makes it ideal for small and large scale networks.

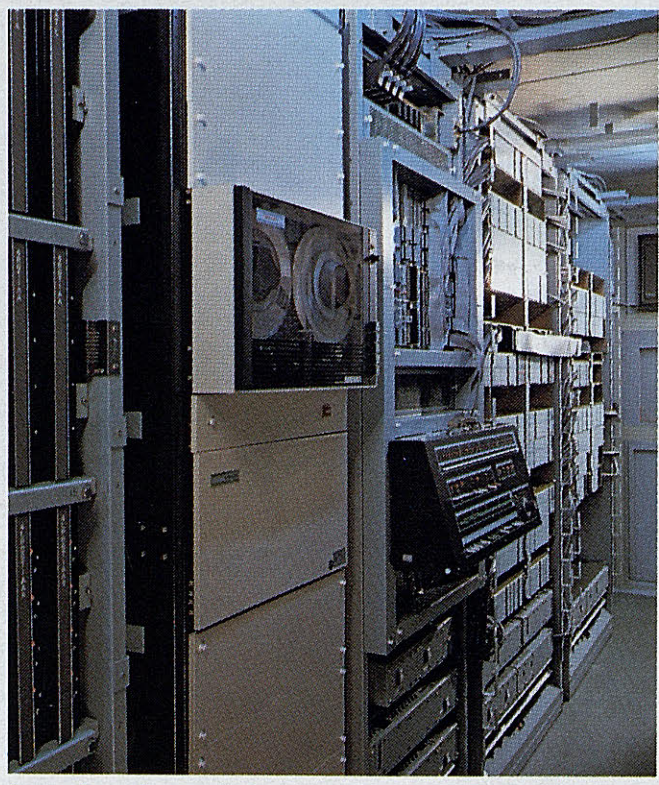
Improved reliability

The FETEX-200 is a fully stored program controlled (SPC) system, and uses a redundancy system configuration and high quality components which give it an availability of more than 99.9994%.

Full compatibility and versatility

The FETEX-200 can be interfaced with any existing telephone network and is designed to handle routing, signalling and future network changes easily and simply. In addition, many software packages are available to give immediate service to new telephone subscribers.

All these features, and more, can be also offered in time division configuration from the FETEX mobile series lineup. And it's ideal either as a temporary or as a permanent exchange. Choose a FETEX-200 system. And see how far it can take you.



Interior view of the compact FETEX-200 mobile system

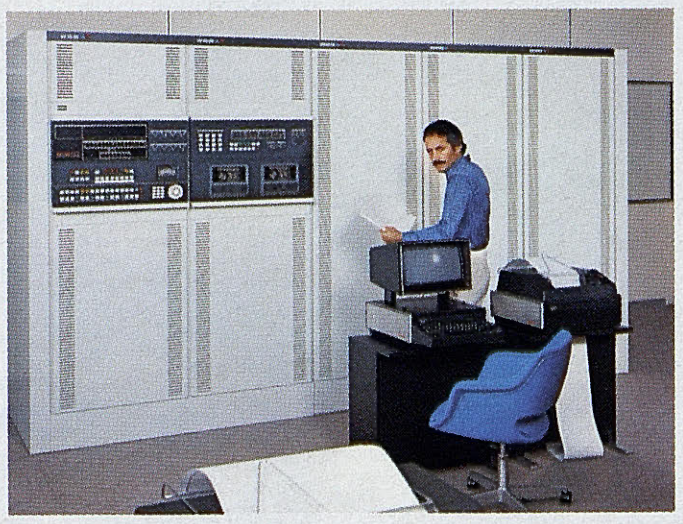
System

Here's another way to get you there

If you're interested in a stationary system, we offer the FETEX-100 (space division) and FETEX-150 (time division) systems. They will also give you the superior reliability, versatility and compatibility that have made Fujitsu a world leader in the field of telecommunications. It's another way that a FETEX system can take you where you want to go.

Space Division System

The FETEX-100 Series is a space division electronic switching system proven worldwide for unsurpassed reliability and compact modularization. The 100S with a line capacity of 32,000 lines and the 100L with 130,000 lines are equipped with the exclusive MEMOREED® and 64K RAM LSIs. And they offer an extremely flexible expansion capability.



Time Division System

The FETEX-150 Series is an advanced time division digital switching system. With a 240,000-line capacity it commands all capabilities offered by space division systems while offering additional features to make operating more efficient and expansion much easier in a digital network framework. These features include a wider application field, a technology independent organization and simple network topology.

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and, of course, international: they adapt to florins, francs, schillings, crowns, dinars, and colons with equal ease. Here's the proof:

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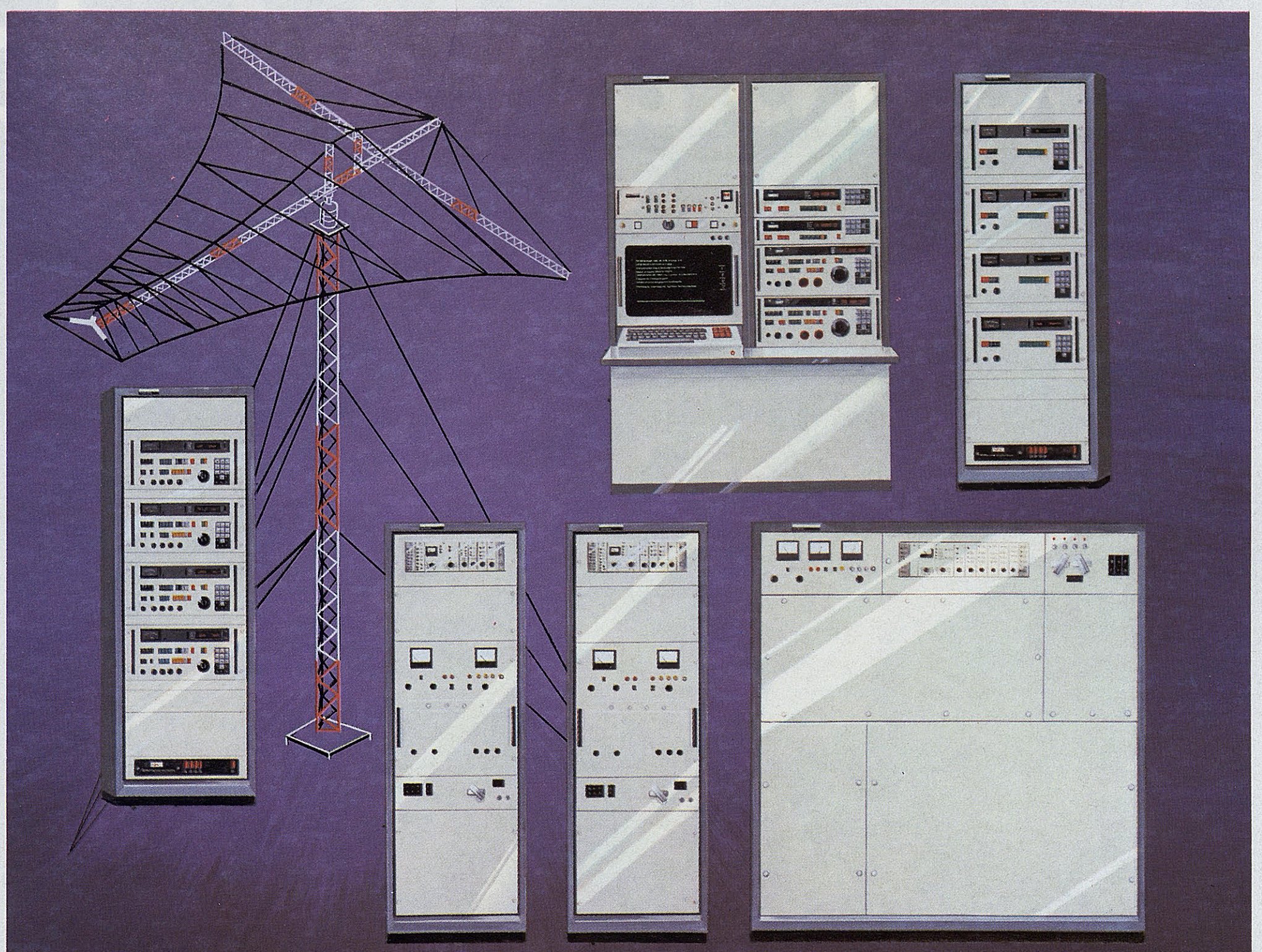

Marconi has total HF systems capability with microprocessor remote control

Marconi's total HF system capability goes back to the inception of HF for long range communication.

From this background of constant innovation and unrivalled depth of knowledge (it was Marconi himself who pioneered commercial HF) comes our latest MFT2 System.

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The advanced technology displayed in MFT2 is characteristic of Marconi engineering. Throughout the whole HF system – transmitters, receivers, synthesized drives, advanced remote control equipment, and a huge range of HF directional and omni-directional antennas, Marconi is showing the way.

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When you're faced with selection of mobile telephones, consider the dependability of Motorola Equipment.

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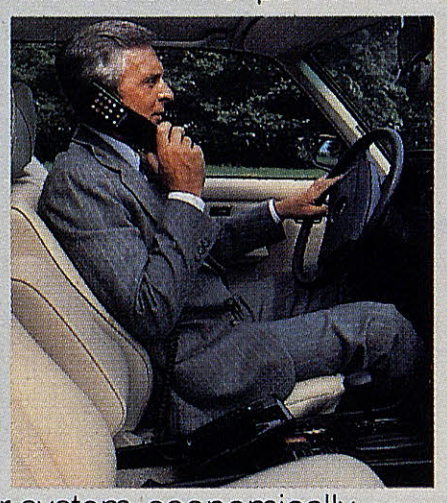
Because telecommunications is one of our primary businesses, Motorola is an expert at meeting your standards. Which means that in addition to supplying mobile telephones, we offer products that can interface with all principal types of land telephone system protocols and exchanges now in use. So that our system becomes your system, economically and efficiently.



Let's communicate.

We'd like to show you how a Motorola mobile telephone system can become an integral part of your telecommunication system. Allow us to audit your present system at no charge. And propose solutions to meet your needs. For more information contact our International Telecommunications Marketing Manager. You'll find that when the world talks, we listen.

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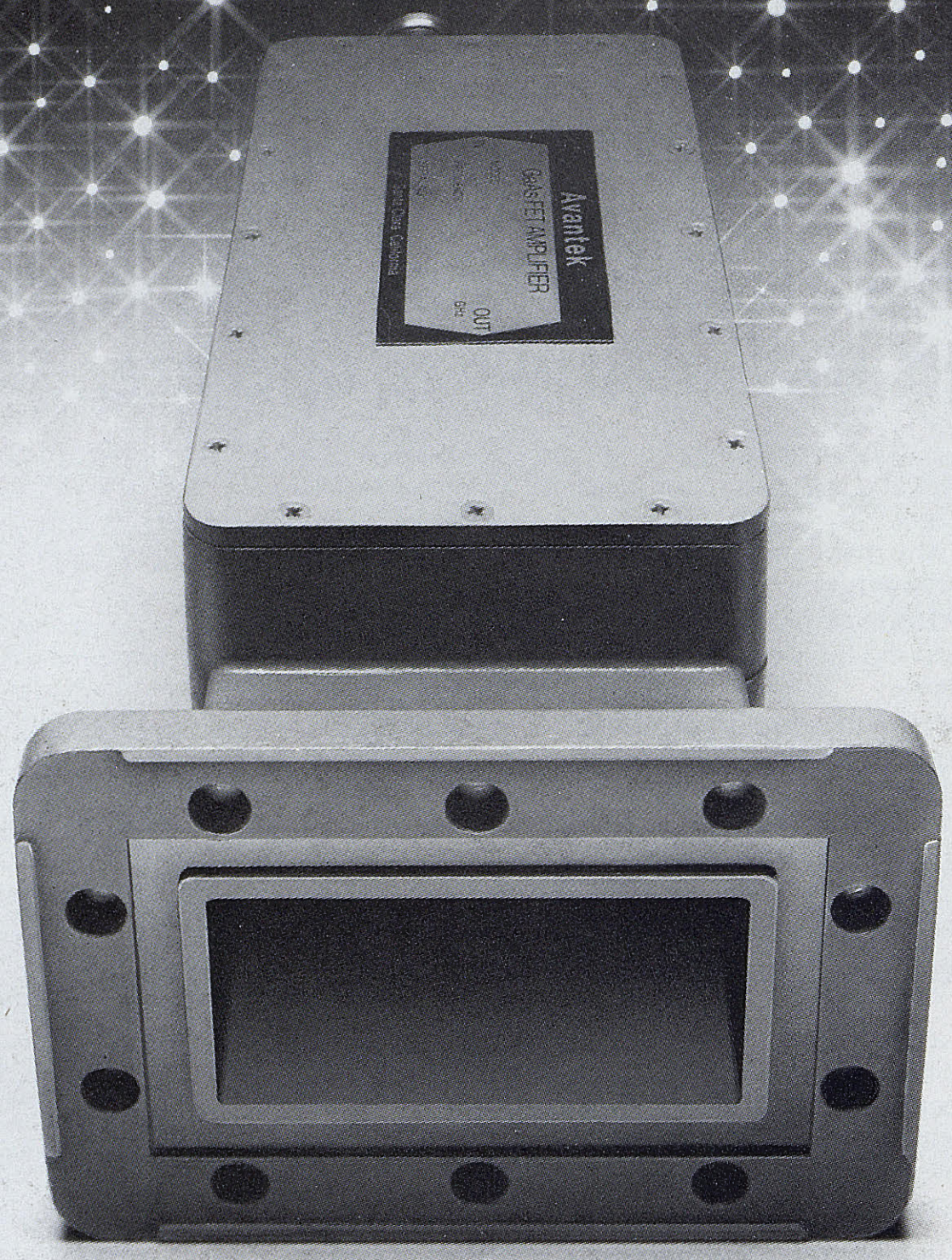

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We can meet your needs and save you money.

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VOLUME 47 - No. V - MAY 1980

Journal télégraphique (1869-1933)
58 volumes published
Telecommunication Journal
(since 1934)
Volume 47

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Published each month by the International Telecommunication Union (ITU) in separate English, French and Spanish editions

All manuscripts submitted for insertion in the "Telecommunication Journal" must reach the Editor at least 45 days before the date of publication.

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SUBSCRIPTION RATE

Editions in three separate languages: English, French, Spanish. For all countries, by surface mail: 75 Swiss francs yearly for one language edition, 150 Swiss francs yearly for two and 225 Swiss francs yearly for three separate language editions. Single copy 7.50 Swiss francs. Special rates for airmail deliveries. The methods of payment are given on the last page of the *Journal.* For all information please apply to the Editorial Office: Place des Nations, CH-1211 GENÈVE 20 (Switzerland). Telephone: national (022) 99 51 11; international+41 22 99 51 11. Telegraphic address: BURINTERNA GENÈVE. Telex: 421 000 uit ch.

Subscriptions can be paid directly to Post Offices in the following countries: Algeria, Austria, Belgium, China, Denmark, Finland, France, Germany (Federal Republic of), Italy, Luxembourg, Morocco, Netherlands, Norway, Portugal, Sweden, Tunisia, Vatican.

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Rates: black and white: 1 page 2500 Sw. fr., ½ page 1350 Sw. fr., ¼ page 775 Sw. fr., discount according to quantity; extra charges for colour and prominent position.

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Message from the Secretary-General of ITU

12th World Telecommunication Day

People living in rural areas throughout the world are experiencing, more than anyone else, the vital need to communicate. Hence, on this 12th World Telecommunication Day, we feel it essential to stress the importance of telecommunications for the social and economic development and well-being of rural populations.

The advent of the space age and the advances in many fields achieved largely through the miniaturization of electronic components have, over the past two decades, made it possible to develop technical facilities of exceptional potential in telecommunications.

For instance, we can look forward to the day when even the most remote rural areas will be in constant communication with the outside world.

- Telecommunication at the service of rural populations means education and continuous vocational training through radio and television.
- Telecommunication at the service of rural populations means meteorological information, so essential to agriculture, received daily at home with, in the case of regions suddenly threatened, the possibility of preparing for natural disasters.
- Telecommunication at the service of rural populations also means swift appeals for medical assistance or other forms of aid to protect persons and property.
- Lastly, telecommunication at the service of rural populations means the priceless advantage of being able to telephone anywhere in the world, thus bringing together all the members of the human family.

Many policy-makers have already taken specific measures to this effect. Thanks to their decisive action and to the international co-operation which exists between the 154 Member countries of ITU, the time has come when this telecommunications potential is to be harnessed for the benefit of mankind as a whole.

M. MILI

Union Activities

Meeting of CCITT Working Party II/2

CCITT Working Party II/2 (Human factors) met in Florence (Italy) from 10 to 14 September 1979 under the chairmanship of Mr. M. S. Schoeffler (Bell Laboratories—United States).

Working Party II/2 is engaged in the study of those questions of Study Group II (Telephone operation and quality of service) which involve primarily an understanding of the needs, capabilities and preferences of customers in international telephony. These are Questions 4, 5, 6 and 7/II. Question 14/II, dealing with the standardization of network tones, is being studied separately by the Special Rapporteur for this question, Mr. A. Lewis (Canada). It was fortunate that Mr. Lewis and his Working Group could participate in the meeting of Working Party II/2 since human factors considerations have a direct impact on their work (see last paragraph of this report). The meeting, which was superbly hosted by the Italian Administration, was attended by 33 delegates from 12 countries.

The study of Question 4/II was conducted with Mr. J. M. Clegg (Canada) as Rapporteur and Mr. B. Hauschildt (Denmark) as Associate Rapporteur. Question 4/II is concerned with determining what problems customers have in direct dialling of international calls. One instrument for finding out what these problems are is a standardized questionnaire used by various administrations. Results were reported and proposals made to include more transmission-oriented questions.

Various contributions indicated that recorded announcements were effective in reducing the number of customer irregularities involving the erroneous use of the national trunk prefix in an international call. Consequently, a Recommendation was drafted to encourage the use of such announcements, and alternative solutions will not be pursued.

Studies were reported regarding telephone number notation on letterheads (Recommendation E.162), in which an alternative format was used. This format is designed to improve customer dialling between the United States, Canada and other countries in Zone 1. Initial results are encouraging and further studies are under way. It was decided to recommend that the study of this question continue into the next study period.

Question 5/II was studied with Mr. G. Wikell (Sweden) as Rapporteur and Mr. J. D. Van Oosten (Netherlands) as Associate Rapporteur. This question is concerned with standardization of symbols and other aspects of subscriber equipment. In this connection studies were reported which consider customer understanding of pictograms to describe various network audible tones. A new draft supplement was proposed which describes how the various parameters of a tone are to be depicted. Information was also provided on how to improve the effectiveness of pictograms to describe the operation of public telephones. A draft Recommendation was prepared on a new standard symbol to designate second dial tone. Work on standard pictograms for medical, police and fire emergency services has not been completed and a proposal for a study of this problem in the next plenary period will be prepared by the Netherlands Administration. This question was also recommended for continuing study in the next plenary period.

Question 6/II was studied with Mr. Wikell as Rapporteur and Mr. S. Stockwell (United Kingdom) as Associate Rapporteur. Question 6/II deals with instructions provided to customers of international direct dialling telephony. Work is proceeding under this question to compile a handbook on how to provide good instructions to customers. One goal of this effort is to increase the degree of standardization of instructions in various countries. It was noted that some administrations provide information on how to place calls home from foreign countries, primarily in the form of pamphlets given to travellers who are leaving the country. The effectiveness of such pamphlets has not yet been demonstrated. It was agreed that work on this question should continue into the next plenary period.

Question 7/II was studied with Mr. B. L. Wattenbarger (United States) as Rapporteur and Mr. V. Alexander (United Kingdom) as Associate Rapporteur. Question 7/II concerns standardization of control procedures for supplementary services. During the past two years studies have been conducted to compare the ability of users to control supplementary services employing the procedures in the schemes of the American Telephone and Telegraph Company (AT&T), the European Conference of Postal and Telecommunications Administrations (CEPT), and Nippon Telegraph and Telephone Public Corporation (NTT) of Japan, which are described in Recommendation E.165. Analysis of the data from these studies was reported, but the subsequent discussion did not lead to agreement on a single standard scheme. For the present, that goal has been abandoned. Instead it was agreed to continue to publish the three schemes (with some revisions in the AT&T scheme) to reduce the likelihood that further new schemes would be introduced and thus make standardization even more difficult. It was agreed that further work would attempt to standardize elements of the procedures. In that effort a draft Recommendation was prepared stating that the message suffix should be designated by the # (square). Future effort will address positive and negative indicators and the formatting of blocks of information. It became clear in these discussions that control procedures used tones as feedback elements and consequently that standardization of tones and control procedures should be studied together. This view resulted in formulating a new draft question to replace both Questions 7 and 14/II (discussed below).

The work programme which the Working Party will recommend to Study Group II for the next plenary period includes continuation of the above questions and a new draft question dealing with human factors aspects of computerized services in international telecommunications.

Mr. Lewis, the Special Rapporteur for Question 14/II, convened his Working Group during the course of the week. As noted above, this question deals with standardization of network tones. The group will revise and update the *Orange Book* listing of tones (Vol. II.2, Supplement *4*). It was decided to postpone action on the use of "comfort" tones or announcements during the post-dialling interval until the next plenary period. A draft Recommendation was prepared which provides standards for application of tones for varying network conditions, and a list of definitions of tones was prepared. This list will be revised and published in the next CCITT Book.

M. S. S.

Meeting of CCITT Study Group V

CCITT Study Group V (Protection against dangers and disturbances of electromagnetic origin) held its second meeting of study period 1977-1980 in Geneva from 28 January to 1 February 1980. The meeting was presided over by the Chairman, Mr. G. Gratta (Italy), assisted by Mr. H. Lorke (German Democratic Republic) and Mr. P. C. Persson (Sweden), Vice-Chairmen.

The meeting was attended by nearly 70 delegates and experts representing the administrations and recognized private operating agencies of 24 countries and by representatives of many scientific or industrial organizations.

In addition, since Study Group V deals with problems of disturbance on telecommunication lines, the International Conference on Large High Voltage Electric Systems (CIGRE) and the International Union of Railways (UIC) were also represented.

Since this was the final meeting of the study period, all the questions assigned to Study Group V were examined.

The principal aim of the meeting was to prepare replies to questions under study, to revise the wording of questions and to propose new questions for study.

Some information on the main results of the meeting is given below.

Questions 1/V and 5/V (Protective devices and Protection of equipment) have been studied together because their separate study, as they were set in 1976, could have given rise to duplication of work.

Proposals were made to revise the questions so that they could be studied separately in the future.

The proposed new Questions 1 and 5/V deal with protective devices and with criteria for protection of equipment, respectively; a new question was proposed, to study methods of testing protection components.

In connection with Questions 1 and 5/V, Recommendation K.11 was revised and Recommendation K.12 will have to be revised during the next period.

A method was proposed for classifying the resistibility of equipment to overvoltages.

It will be readily understood that the two proposed questions are topical, since equipment protection techniques are about to undergo profound changes owing to the introduction of solid-state components into all equipments, including switching devices.

A change in the wording of Question 3/V (Problems posed by the arrangement of protective devices) was suggested, so that the question should cover disturbances caused by the operation of protective devices in all types of transmission system (analog and digital).

In connection with Question 9/V, a draft new Recommendation was adopted, relating to the joint use of trenches and pipes to accommodate telecommunication cables.

Question 9/V will be amplified to cover the harmful effects of electric installations earthing connections on telecommunication cables.

The effects of harmonics circulating in traction and power lines were studied under Question 15/V.

In particular, the part relating to traction lines was dealt with in a Joint UIC/CCITT Working Party. The study will be pursued. A proposal for establishing the Joint Working Party on a permanent basis will be put before the Plenary Assembly.

A draft new Recommendation in Series K was adopted, concerning a method for estimating induced voltage from radio station emissions and for reducing harmful effects.

During the past two study periods, some very detailed discussions took place in Study Group V on the possibility of increasing the values of permissible induced voltage on telecommunication lines.

The opinion, already expressed during the preceding meeting, that there were insufficient grounds for accepting such an increase was confirmed at the final meeting.

The pertinent question (Question 25/V) was therefore suspended, although the study could still continue in connection with the revision of the "Directives".[1]

Question 26/V relates to the revision of the "Directives". This revision is, of course, still in progress, and a "Directives Editorial Group" of Study Group V has been set up to draft texts for insertion in the "Directives" as Study Group V approves their technical content.

Since the "Directives" constitute the basic CCITT publication on protection, a proposal was made for their complete rearrangement in order to meet users' requirements more satisfactorily.

In practice, this will entail dividing the publication into several handbooks; so far, nine subjects for handbooks have been singled out.

It may be possible in future to consider introducing into the publication the contents of other existing handbooks and changing the general title if necessary.

Meanwhile, some new texts have been adopted for inclusion in the "Directives", relating to a variety of subjects, including autotransformers used on traction lines and "active reduction systems".

Apart from the question on the testing of protective devices, two new questions were set for study, one concerning disturbance from power-line carrier systems and the other on the harmful effects of geomagnetic storms.

G. G.

[1] "Directives concerning the protection of telecommunication lines against the adverse effects of electricity lines"

Technical Co-operation

Thailand radio frequency management and monitoring project progresses

The ITU/UNDP project supporting the management and monitoring of radio frequencies in Thailand has made considerable progress in a number of fields of activity.

The national frequency register is nearing completion, the necessary data having been collected from wireless users and operators.

Implementation of the medium-wave broadcasting plan is well under way. The plan follows the recommendations of the Regional Administrative LF/MF Broadcasting Conference (Geneva, 1975) which came into force on 23 November 1978. The implementation required changing the broadcasting frequencies of 150 radio stations throughout Thailand. Close monitoring of broadcasting frequencies while the changes were being made, and for several months afterwards, ensured a satisfactory changeover to the new frequencies.

Since FM broadcasting is used intensively and requests for new channels are increasing, a new national FM broadcasting plan was prepared which is now being considered by the government.

The ITU also provided the services of a consultant for 10 weeks to draw up a national plan for the television network. The plan includes proposals for television transmitters, interconnection and the use of channels. It also includes recommendations on the possible use of microwave system capacity and future linkages through satellite. The Thai Government is now studying this plan.

As in other countries, the recommendations and Final Acts of the 1979 World Administrative Radio Conference are being reviewed. It was decided that additional technical assistance for four months would be needed to enable the administration to review the Final Acts and to prepare plans for their implementation. A revision of the project providing for additional UNDP input to allow for this assistance has recently been approved.

New Committee to increase Kuwait TTI effectiveness

A Steering Committee has been formed to increase communication and co-operation between the Kuwait Telecommunications Training Institute (TTI) and the ministries using its capabilities and resources. Members of the Committee represent the Ministries of Communication, Information, Planning, Social Affairs and Labour, Education and the Civil Service Commission.

The formation of the Committee supports the 24-month phase IV of the ITU/UNDP project to develop the Institute. The phase began in July 1979 and includes 282 man-months of service by 14 experts, 67 man-months of fellowships and 100 000 US dollars' worth of equipment.

The project has, since its inception in 1972, progressed steadily towards its goals of establishing relevant telecommunications training programmes and developing an organization totally operated by Kuwaiti nationals. In the last scholastic year (1978-1979) a total of 363 trainees received 16 106 student-weeks of training: 3664 for technicians, 3318 for assistant technicians, 8569 for operators and 555 for in-service training. Experts trained 38 instructors in various specialties and some of the counterparts conduct classes independently and help develop courses.

As a result of the high quality of training, some universities in the United States have indicated their willingness to grant partial credit for TTI trained technicians who enroll for bachelor degrees in electronic engineering.

Some of the equipment bought through the ITU has already been installed and a computer/microprocessor laboratory and a digital techniques laboratory are nearing completion.

Bangladesh Telecentre project expanded, extended

The ITU/UNDP project supporting the development of the Bangladesh Telecentre for telecommunication training at Dacca has been expanded and extended to March 1981.

Upon independence, Bangladesh had one of the lowest telephone/population ratios in the world—one telephone per 1000 inhabitants. The government therefore launched a programme for the rapid development of telecommunications services. Targets of the first five-year plan (1973-1978) included installation of 70 000 telephones, 460 trunk and telegraph circuits, 500 public call offices and the introduction of direct dialling between 40 major towns.

A two-year approach plan (July 1978-June 1980) was then activated to speed up the implementation of 40 on-going projects, initiate 14 new projects and prepare realistic plans for the second five-year plan (1980-1985).

The circumstances of independence left the Telegraph and Telephone Board with comparatively few trained personnel at any level. However, sufficient numbers of adequately trained staff are essential for the installation, operation and maintenance of the telecommunication system under development.

It was to meet this need that the ITU/UNDP project to upgrade the quality, capacity and scope of the training facilities at the Telecentre was conceived in 1972. Buildings to house training facilities were extensively remodelled and expanded, new buildings were constructed and a considerable amount of new equipment was installed. Since project activities started in 1975, a number of courses have been revised, subjects increased and a plan to steadily reduce the training backlog, give refresher training and train new personnel—a total of some 3000 staff per year—is being implemented. Two practical seminars for middle and senior managers of the T&T Board were recently held, one on "telecommunication management" and the other on "telecommunication traffic".

The revised project provides increased and new expertise and additional equipment and fellowship training to strengthen the two-year approach plan. It calls for significant new contributions from the government and UNDP and should help provide a strong base for the launching of the second five-year plan.

Three new elements added to Indian ALTTC project

A significant project revision and extension signed in April 1979 is resulting in three important new components for the Advanced Level Telecommunication Training Centre (ALTTC) project at Ghaziabad (New Delhi), India.

To serve its vast and diversified telecommunication network, the Indian Posts and Telegraphs Department has roughly 250 000 employees in the telecommunication field. This requires the training of about 16 000 persons per year, including 3000 professional engineers. For this purpose, the Indian P&T have established 14 Regional Telecommunication Training Schools (RTTSs) and 25 District/Circle Telecommunication Training Centres (DTTCs) which carry out formal training.

However, since telecommunication techniques are developing so rapidly that the knowledge of a newly graduated engineer is obsolete in five years, it was felt necessary to create a Centre for continuous refresher training for middle-ranking and executive officers of the P&T. To meet that need, the ITU/UNDP project was agreed upon in 1972 to develop the ALTTC. In the first phase of the project an interim training facility was established in the new P&T headquarters building in New Delhi. Class-

room, printing, audio-visual and other support facilities were set up to support an ambitious programme of advanced-level short-term courses and seminars, which have since been conducted on a regular basis. Since 1976 the Centre is also responsible for providing training for RTTS and DTTC instructors.

In parallel, construction was begun at a large, open campus at Ghaziabad, about 20 km from Delhi, to provide modern classroom and laboratory buildings, a hostel and support installations. ALTTC activities were gradually moved to Ghaziabad starting in May 1979, when the first block of classrooms and laboratories was ready for occupancy. When completed in 1981, the Ghaziabad campus will be of international standard, which will permit India to implement an important element of Technical Co-operation among Developing Countries (TCDC), built into the ALTTC project. The Government of India has elected to make a significant amount of its own UNDP Country Programme funds available each year to pay transportation and living expenses for telecommunication engineers and managers from other developing countries in the Economic and Social Commission for Asia and the Pacific (ESCAP) region and among the English-speaking countries of Africa to attend courses and seminars at the ALTTC, within the framework of the ITU/UNDP project.

During the 1977 Tripartite Review of the ALTTC project, it was noted that certain areas of development were not fully covered by the existing project and that the ALTTC concept should be extended to incorporate three new components.

The Training Development Centre (TDC)

The Project Review Mission found that the P&T had identified a need to considerably restructure its training pattern. The generally academic orientation of courses makes them lengthy and expensive. Shorter, task-oriented courses would be more efficient, cut down on training costs and place trainees in the field much earlier.

The ITU/UNDP CODEVTEL* project has proved that high-quality training packages can be produced on basic, common subjects that can then be exchanged and used in many countries, adapted as necessary. Over 80 such CODEVTEL training modules have been produced so far and hundreds would be needed to meet India's training requirements.

In order to develop course material and train course developers, instructors and course administrators, it was proposed to set up a Training Development Centre as an integral part of the ALTTC.

The Computer Application Unit (CAU)

Computers are increasingly taking over switching functions in both telephone and telex exchanges. A 2000-line prototype stored-program control exchange has been installed in New Delhi and large-scale adoption of computerized telecommunication operations is likely.

As a result, the P&T Department will need an ever-increasing number of fully-trained computer programmers, operators and maintenance personnel each year.

Since the project has already acquired a reasonably-sized processor, it was proposed that a full-fledged computer faculty and the CAU be formed as part of the enlarged ALTTC activities.

The Satellite Communication Training Facility (SCTF)

After successful experimentation with nationwide satellite transmission, the Government of India has signed a contract with the United States National Aeronautics and Space Administration (NASA) for the launching of an Indian domestic satellite in March 1981 to improve telecommunications all over the vast country.

To implement the Indian National Satellite System *(INSAT)*, the P&T Department will install at least 35 satellite earth stations over the next three years. This requires the training of about 600 engineers and technicians during the next two years and about 100 per year thereafter. Among the most important subjects of training will be alignment procedures, fault location, repair and maintenance. This type of training cannot be carried out on working or standby equipment.

Since the ALTTC campus at Ghaziabad has acquired additional land, it is proposed that a small satellite communication earth station for training be erected and an appropriate faculty be established as part of the project extension.

Adding the three new components to the revised project extends it through 1982 with significantly increased contributions from UNDP and the Government of India.

Upon completion, the ALTTC, co-operating and co-ordinating with other national and regional telecommunication training centres, should be fully self-sufficient in operations with the regular visits of outside experts to help update training courses as equipment and techniques continue to evolve.

Jordan TTC laboratories and workshops nearing completion

A major step in the ITU/UNDP project to develop Jordan's Telecommunication Training Centre (TTC) at Amman will be reached with the completion and equipping of the laboratories and practical training workshops.

A revision has been approved which reschedules the project through the end of 1981. It also provides for the services of a subscribers' equipment expert, consultants in manpower planning and education technology, additional fellowships and 30 000 US dollars' worth of equipment.

A 1979 policy decision to adopt the ITU Instructor Guide Format for all courses has been put into practice. The course for newly recruited engineers was also revised and implemented.

During the past year, 498 students completed 54 courses for a total of 3184 student-weeks, a 50% increase over 1978.

More fellowships

Thirteen more fellowships were implemented in the first weeks of March 1980. Recipients come from seven countries: Afghanistan, Brazil, Fiji, India, Nepal, Sri Lanka and Western Samoa.

Four are studying satellite communications, and three each CODEVTEL training techniques and teletraffic engineering. Two are increasing their knowledge of digital communications and the other, optical fibres.

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* CODEVTEL = Course Development in Telecommunications. Beginning in 1972, an early step was the compilation of "Training Development Guidelines" (TDG). In effect, course subjects of use to the maximum number of countries and trainees are selected and countries are identified and assigned to develop the courses in accordance with TDG standards. The resulting courses are thus suited to the real needs of a large number of users.

Recruitment of experts

Six new posts have been announced:

- Senior instructor in local line plant
- Senior expert in management services
- Expert in management services (United Arab Emirates—one year, with possibility of extension)
- Regional expert in planning of sound and television broadcasting services (ESCAP, Thailand—18 months, with possibility of extension)
- Regional expert in training, sound and television broadcasting engineering and operations (AIBD, Malaysia—18 months, with possibility of extension)
- Senior training and maintenance expert in radiocommunications (Equatorial Guinea—one year)

For details, see "Official Announcements".

Departures on mission

country and place of assignment	expert	assignment	period of contract and programme*
Cameroon Yaoundé	Masson J.-C. (Switzerland)	Senior technician in transmission (radio-relay systems) at the Rehabilitation Unit (NRU)	3.3.80-2.3.81 UNDP
	Bovy J.-C. (Switzerland)	Administrator (office organization and management) at the Rehabilitation Unit (NRU)	4.3.80-3.3.82 UNDP
Indonesia Bandung	Guillocheau J.-M. (France)	Senior expert in PCM transmission at the Telecommunication Test and Development Centre	1.3.80-31.8.81 UNDP
Sri Lanka Colombo	Fawkes C. (United Kingdom)	Senior expert in manpower development	3.3.80-2.5.80 UNDP
Switzerland Geneva	Crisp M. H. (Australia)	Specialist in space telecommunications (earth stations) for a mission in West Africa (Senegal, Gambia and Cape Verde)	2.3.80-14.3.80 FT
Yemen (P.D.R. of) Aden	Tanem T. (Norway)	Senior expert in radio-relay links	5.3.80-24.3.80 FT
Zaire Kinshasa	Bünger W. J. (Netherlands)	Senior expert in organization and methods	13.3.80-12.5.80 FT

* UNDP = United Nations Development Programme.
FT = Funds-in-Trust.

Obituary

Georges Valensi

Georges Valensi, "father" of the ITU's International Consultative Committees and responsible for important inventions in the field of colour television, died in Paris on 19 March 1980.

Georges Valensi was born in Algiers on 11 November 1889. After graduating from the *Ecole polytechnique* (Paris) and the *Ecole nationale supérieure des télécommunications*, he entered the French PTT as an engineer in 1912.

In 1919 and 1920, he set up the laboratory of the French Administration's Technical Research Department, the nucleus of the present *Centre national d'études des télécommunications*. Between 1921 and 1923, he installed the first French national broadcasting station.

Then, in 1924, came his entry on the international scene with his appointment, at the early age of 35, as Secretary-General of what was to be known as the International Telephone Consultative Committee (CCIF). For over twenty years, until his retirement in 1956, Georges Valensi guided the destiny of this highly productive international body until its amalgamation in 1956 with the CCIT to form the existing International Telegraph and Telephone Consultative Committee.

But the heavy responsibility of directing the CCIF did not absorb the whole of his intellectual energy and vision. In 1927, at the *Conservatoire des arts et métiers* in Paris, he set up a laboratory for the European Basic Telephone Transmission Reference System, and in the same year he created the first section of the International Joint Committee for Tests relating to the Protection of Telephone Lines. From 1920 to 1938, he was a lecturer at the *Ecole supérieure des postes et télégraphes*.

But it is as an inventor, perhaps, that Georges Valensi most clearly demonstrated his versatility and originality. In 1927, he patented an ion relay. Fascinated by television from its infancy, he conducted television experiments with reception on cathode ray oscillographs in the French PTT Research Department as long ago as 1923. Between 1938 and 1940, he took out a number of United States, British and French patents, in which the principles of compatibility in colour television—the basis of all colour television today—were first announced.

After his retirement from the ITU, he continued research on colour television, and at the 1961 Montreux Symposium he presented two new methods for reception of colour television pictures on large screens.

In 1979 the ITU Administrative Council made the first award of the Union's Centenary Prize to Georges Valensi for "his exceptional contribution to the development of international telecommunications".

R. L. Smith-Rose

Dr. R. L. Smith-Rose, former Chairman of CCIR Study Group 5, died on 19 March last at the age of 85.

Born in 1894, Reginald Leslie Smith-Rose was educated at Imperial College, London University, where, in 1914, he received the Governor's Prize for Physics as well as first-class honours in the same subject in his B.Sc. degree. In 1915, he obtained the Diploma of the Imperial College in electrical engineering.

After four years in industry, he joined the staff of the National Physical Laboratory (of whose Radio Division he was Superintendent from 1939 to 1947). And in 1920 he became associated with the work of the newly-formed Radio Research Board of the Department of Scientific and Industrial Research. In the course of this work, he was responsible for conducting extensive investigations in radio direction finding, the electrical properties of soil and sea water and the propagation of radio waves over the ground and through the lower atmosphere. It was during this time that he received his Ph.D. (1923) and D.Sc. (1926) at London University.

In 1948 he was appointed to the new post of Director of Radio Research in the Department of Scientific and Industrial Research. His headquarters were the Radio Research Station at Slough. In the twelve years that he held this post, the Radio Research Station became well-known throughout the world for its work in the fields of radio wave propagation, ionospheric and tropospheric research, radio atmospheric noise, secondary radio standards and measurements and observations and predictions on the trajectories of rockets and satellites. Intensive work programmes were carried out for the International Geophysical Year, and International World Data Centres for radio, and for rockets and satellites, were established at Slough.

Dr. Smith-Rose was twice a member of the Council of the Institute of Electrical Engineers (IEE) from 1953 to 1956 and again from 1960 to 1961. He was Vice-President from 1961 to 1964.

In 1960 he was elected President of the International Scientific Radio Union (URSI), an office he held until 1963.

No record of Dr. Smith-Rose's work in the field of international radio would be complete without mentioning that he was Chairman of CCIR Study Group 5 on tropospheric propagation (later to include propagation in non-ionized media), from its inception in 1949 until 1970. It is a further measure of the high international regard in which he was held that he was Secretary-General from 1961 to 1973 of the Inter-Union Commission on Frequency Allocations for Radioastronomy and Space Science.

At the 50th Anniversary celebrations of the CCIR in Kyoto in 1978, Dr. Smith-Rose received a CCIR Honour Award for his "technical contributions in radio wave propagation and leadership in the work of CCIR from 1931 onward".

John A. Saxton

As we go to press we have learned of the death of Dr. J. A. Saxton on 17 April after a short illness. At the time of his death Dr. Saxton was Chairman of CCIR Study Group 5. In October-November 1978 he was Chairman of the Special Preparatory Committee of the CCIR for WARC-79. An obituary will be published in a forthcoming issue.

Conferences or meetings external to the ITU

Third International Telecommunications Energy Conference and Exhibition (INTELEC)

The need to conserve and manage energy, upon which telecommunications equipment and services are wholly dependent, coupled with the rapidly changing power design requirements for modern switching, transmission and computing equipment, has seen the establishment of INTELEC as an important international forum. More than 450 delegates attended the recent meeting held in Washington, DC, during November 1979, with representatives from 25 countries.

INTELEC 81 will be held at the Royal Lancaster Hotel, London, from 19 to 21 May 1981, and there will also be a trade exhibition at which manufacturers will display their latest equipment and components. The Conference will cater for those involved in the design, development, manufacture, installation, and operation of telecommunications power plant and the management of energy resources. Topics to be covered are:

— DC power plants
— distribution of power
— battery and load rectifiers
— batteries
— DC-DC converters
— power for switching, transmission or customers' apparatus
— inverters
— power supplies for computers
— AC uninterruptible power systems
— technology of power: magnetics, devices and components
— AC standby power systems and choice of fuels
— engine driven alternators, solar systems, fuel cells
— building environmental systems
— energy management and conservation
— economics of power systems
— cable and bus-bar systems
— power control and supervisory systems
— psophometric noise and filters.

The Conference is being organized by the Institution of Electrical Engineers (IEE), in association with a number of allied societies. The Organizing Committee invites offers of contributions for consideration for inclusion in the programme. The closing date for offers is 30 May 1980. Further details may be obtained from: "INTELEC 81, The Institution of Electrical Engineers, Savoy Place, London WC2R 0BL (United Kingdom)".—*INTELEC 81.*

Calendar of non-ITU scientific and technical meetings

date	place	title and organizer	further information from
1980			
1-3 June	Paris	1st European fibreoptics and communications exposition (EFOC 80) *Information Gatekeepers Inc.*	Hawley Russell 5, rue Davioud 75016 Paris (France) Tel.: 525 7085 or Information Gatekeepers Inc. 167 Corey Road, Brookline Massachusetts 02146 (United States) Tel.: (617) 739 2022
7-11 September	Ottawa	IIC Annual Conference *International Institute of Communications*	Robert Tritt IIC, Tavistock Square, London WC1H 9LG (United Kingdom) Tel.: +441 388 0671
8-12 September	Warsaw	10th European Microwave Conference *Association of Polish Electrical Engineers (SEP) with Microwave Exhibitions and Publishers Ltd.*	Microwave Exhibitions and Publishers Ltd. 36 High Street Sevenoaks, Kent TN13 1JG (United Kingdom)
15-19 September	Berlin	Seminar on fibre and integrated optics *George Washington University, Washington, DC*	German Convention Service Joachimstalerstrasse 19 1000 West-Berlin 15
27-30 October	Atlanta	5th International Conference on Computer Communication (ICCC-80) *International Council for Computer Communication*	ICCC-80 Executive Committee PO Box 280, Basking Ridge New Jersey 07920 (United States) Tel.: +1 201 221 8800
6-12 November	Munich	Electronica 80—9th International Exhibition for components and electronic sub-assemblies *Münchener Messe- und Ausstellungsgesellschaft mbH*	Münchener Messe- und Ausstellungsgesellschaft mbH Postfach 12 10 09 D-8000 München 12 (Federal Republic of Germany) Tel.: (089) 51 07 229 Telex: 5 212 086 ameg d
15-19 December	Berlin	Seminar on data communication systems and networks *George Washington University, Washington, DC*	German Convention Service Joachimstalerstrasse 19 1000 West-Berlin 15
1981			
12-14 January	Honolulu	Pacific Telecommunications Conference *Pacific Telecommunications Council*	Richard J. Barber Pacific Telecommunications Council 2424 Maile Way # 719 Honolulu 96822 (United States) Tel.: +1808 948 8019 Telex: 63 41 34
23-26 March	Geneva	5th International Conference on Digital Satellite Communications *INTELSAT, Telespazio, IIC, AEI, IEEE Region 8*	Telespazio SpA Corso d'Italia, 43 00198 Roma (Italy) Tel.: +39 6 84 97 313 Telex: 61 06 54 tspzro
19-21 May	London	3rd International Telecommunications Energy Conference (INTELEC 81) *Institution of Electrical Engineers*	INTELEC 81 Secretariat IEE, Savoy Place London WC2R 0BL (United Kingdom)
30 May-4 June	Montreux	12th International Television Symposium and Technical Exhibition	Chr. Kobelt Swiss PTT, Viktoriastrasse 21 CH-3030 Bern (Switzerland)

THE JOURNAL

One hundred years ago

News.

The Portuguese Parliament has just adopted a Government Bill relating to the reorganization of the postal and telegraph services of the Kingdom.

This reorganization Bill, which consists of 118 articles together with several annexes, will combine the post and telegraph, including the lighthouse service, under the same Department of the Ministry of Public Works. In addition to the Secretariat of the Director-General, the Central Administration comprises two divisions each headed by an Inspector, one for the postal service and the other for the telegraph and lighthouse services. For telegraph service purposes, the country is split up administratively into two districts, that of Lisbon and that of Oporto.

. . . . .

* * *

The Russian Government has just approved a new internal tariff system to supersede the present 20-word system. Under this system, which the Administration hopes to be able to introduce on 1 July, the territory of the Empire will be divided for tariff purposes into three parts. The first part covers the whole of European Russia as far as the Ekaterinburg meridian and includes the Russian Caucasus; the second embraces Asian Russia as far as the meridian of Stretinsk including Turkestan, and the third encompasses the whole of the territory between this meridian and the eastern border of the Empire.

Each of these three parts will in turn be subdivided into three zones; the first with a radius of 200 versts [1]); the second with a radius of 1000 versts and the third covering all the territory beyond.

The charge will be based on a minimum of ten words. This minimum will cost 30 kopecks [2]) in the first zone, 60 kopecks in the second and 1 rouble 20 kopecks in the third. For each additional word over ten, a charge of 2½ kopecks will be levied in the first zone for which, in order to avoid fractions, the additional charge will always be rounded off to the nearest higher even number of kopecks. In the second zone, 5 kopecks will be levied per additional word and 10 kopecks in the third zone. For telegrams exchanged between one of the three above-mentioned parts of Russia and one of the two others, the charge will be made up of the addition of the various charges levied in each part into which the route is divided.

Journal télégraphique—May 1880

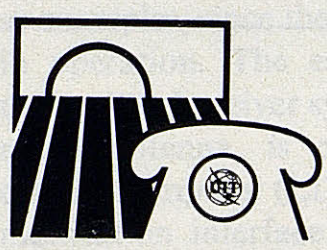
[1]) 1 verst = 1067 metres.

[2]) The rouble, which is divided into 30 kopecks, represents just over 4 francs.

17 May 1980

World Telecommunication Day

"Rural telecommunications"



The 12th World Telecommunication Day, 17 May 1980, is now being actively prepared in the 154 Member countries of the ITU. The Administrative Council chose "Rural telecommunications" as the theme for this year.

Among its multiple activities the ITU is studying the problems of inadequate telecommunication infrastructure in rural and remote areas of the world, and has begun implementing solutions which will bring such regions to an acceptable level.

As part of the Union's information campaign for World Telecommunication Day the ITU's Public Relations Division has made available to administrations and the press a series of articles in the form of press releases on different aspects of this year's theme.

The articles are as follows:

- Rural telecommunication infrastructure development (press release ITU/80-2 of 20 January)
- "Just suppose..." (press release ITU/80-3 of 7 February)
- Solving the problem of rural telecommunications (press release ITU/80-6 of 29 February)
- The application of telecommunications to development (press release ITU/80-8 of 18 March)
- CCITT activities in the field of rural telecommunications (press release ITU/80-9 of 11 April)

A selection of black and white photographs to illustrate the theme of the Day is also available (see *Telecommunication Journal*, March 1980).

The "Journal" has already published, in December 1979 and February 1980, several articles on rural telecommunications.

World Telecommunication Day

Handbook on rural telecommunications

The recently published 308-page *Rural telecommunications* handbook will be of interest to all those concerned with this important branch of telecommunications.

The handbook has been prepared by the CCITT in response to the need expressed by the telecommunications administrations of many developing countries. The principal focus of this manual's texts is therefore on the problems of telecommunications development encountered in many countries where a rural character prevails throughout the national society. Nevertheless, all countries, including those that are highly industrialized, have areas or "pockets" of rural populations that enjoy less adequate telecommunications services than the urban populations. Inasmuch as there may be a similarity of technically and economically indicated solutions, this manual will prove useful also to rural applications problems in the more highly developed countries.

The handbook's nine chapters cover:

— telephone and telegraph planning
— telephone stations and switching
— transmission systems, subscriber distribution systems and services other than telephony
— investments and financing
— operation
— feasibility studies
— miscellaneous aspects
— rural broadcasting and television
— a detailed example of the development of a rural telecommunication network.

The handbook also includes a glossary of terms and a bibliography.

Rural telecommunications, which is published in separate English, French and Spanish editions, can be ordered using the coupon below.

ORDER FORM

To be returned to the following address **together with your remittance:**

International Telecommunication Union
General Secretariat
Sales Service
Place des Nations
CH-1211 Genève 20 (Switzerland)

Please send:

Title of the publication	ISBN No.	Number of copies* F	E	S	Price per copy Sw. fr.	Total Sw. fr.
Télécommunications rurales	92-61-00822-4				103	
Rural Tele-communications	92-61-00821-6				103	
Telecomunicaciones Rurales	92-61-00823-2				103	
					Total	

* F = French E = English S = Spanish

Administration/Company/Organization/Name: (print only one letter per space)

16 1 17 49

Address:

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Date: _____

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In payment whereof we are sending you:

**) a bank transfer (to the Société de Banque Suisse, Geneva) for an amount of _____ Swiss francs
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**) a cheque in another currency, convertible into Swiss francs, covering the amount of the purchase at the price quoted in Swiss francs.

Despatch will be made as soon as payment is received.
Payments are to be made out exclusively to the order of the General Secretariat of the International Telecommunication Union.

**) Delete whatever is not applicable

Ideas and Achievements

"Stella": a European satellite data-transmission system

A NEW European system for the high-speed transmission of scientific data by satellite between various parts of Europe was inaugurated at a ceremony at CERN, Geneva, on 6 March 1980.

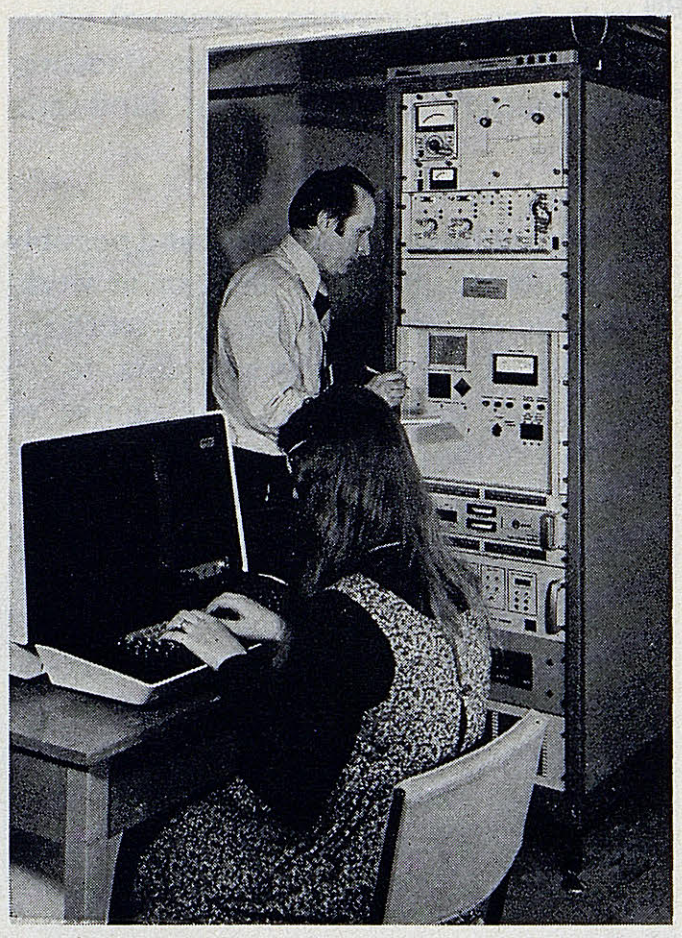
The *Stella* experiment is the result of collaboration between the European Organization for Nuclear Research (CERN), the Commission of European Communities (CEC) and the European Space Agency (ESA).

Stella will provide rapid low error data transmission for large amounts of electronic data from CERN to a number of laboratories in the member States.

It will use the European geostationary telecommunications satellite *OTS-2*, launched in May 1978 (see *Telecommunication Journal*, August 1978, pages 431-434). The experiment will explore low error transmission techniques for data at up to 1 Mbit/s.

Two clear aims for Stella have appeared as being of interest to the participants and technically feasible: firstly, to explore how far very low bit error rates (10^{-9} or better) can be achieved with small earth stations working in the new 11-14 GHz frequency band by using special coding techniques; secondly, to make an experimental evaluation of the uses and worth of Megabit/second data links in the realistic environment of high-energy physics data processing. Both these aims are very relevant in the general development of informatics. Distributed data processing and the use of networks is one of the main growing points in the industry and it is highly desirable to try out systems which break completely new ground—as would a Megabit/second network between user computers—in real life and for an adequate length of time. Questionnaire surveys of future user needs are in practice effectively limited to showing up expansions in conventional services: only practical trial can stimulate imagination and demand for the unknown.

From the initial contacts between the CEC, ESA and CERN the participation grew to include high-energy physics laboratories in United Kingdom (Rutherford, Didcot); Federal Republic of Germany (DESY, Hamburg); Italy (*Istituto Nazionale di Fisica Nucleare*—INFN, Pisa); France (*Commissariat à l'énergie atomique*—CEA, Saclay) and, with interest mainly in the satellite transmission aspects, Ireland (University College, Dublin) and Austria (Technical University, Graz). The project as a whole was approved by the European Community Council of Ministers in September 1977, with a partial financing of



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The terminal at Rutherford Laboratory
(GEC-Marconi Electronics Ltd.)

420 000 AU, as part of the CEC programme of actions for development of informatics. Equipment for the various national laboratories has also been provided by their respective authorities. The earth stations are operated under the responsibility of the national PTTs.

One of the practical problems and challenges in Stella is that most of the equipment in each laboratory is different from that in the others: earth stations are being made by at least five suppliers and several different types of computer have been provided to drive their stations by the laboratories concerned. To ease this problem of potential incompatibility of equipment, the computer software has been written in a transportable language by Rutherford Laboratory and a universal high-speed interface to go between computers and earth stations has been designed and made in series by CERN.

The Stella system and experiments

The Stella experiments aim principally at two topics in the wide field of distributed-data processing:

— very low error rate satellite links and their control;

— user requirements for high-speed data transmission between laboratories collaborating in research requiring heavy data processing.

The equipment for Stella must therefore have facilities for measuring link performance and error rates under a range of operating and environment conditions, and also be able to be used in a routine manner as a fast data link between physics experiments and computer installations in CERN and in the other laboratories.

The main components and their insertion into the existing data processing systems of high-energy physics are shown in figure 1, using CERN and Rutherford Laboratory as examples, since they are the first stations in operation. The earth station, i.e. the transmitter/receiver system and its 3 m diameter antenna, is controlled by a link driving computer (LDC) via a special communication interface module (CIM). The data to be transmitted are stored temporarily on magnetic tape at the LDC and written onto tape by the LDC at the receiving station. At CERN, the data will in general reach the LDC from the data acquisition computer attached to the physics experiment via the CERN internal high-speed network *Cernet*; at Rutherford Laboratory, the LDC is attached to their local *Ethernet* and can transfer the received data to their central computers for processing. Thus the Stella satellite link makes the connection between two, quite different, high-speed local networks, which poses in

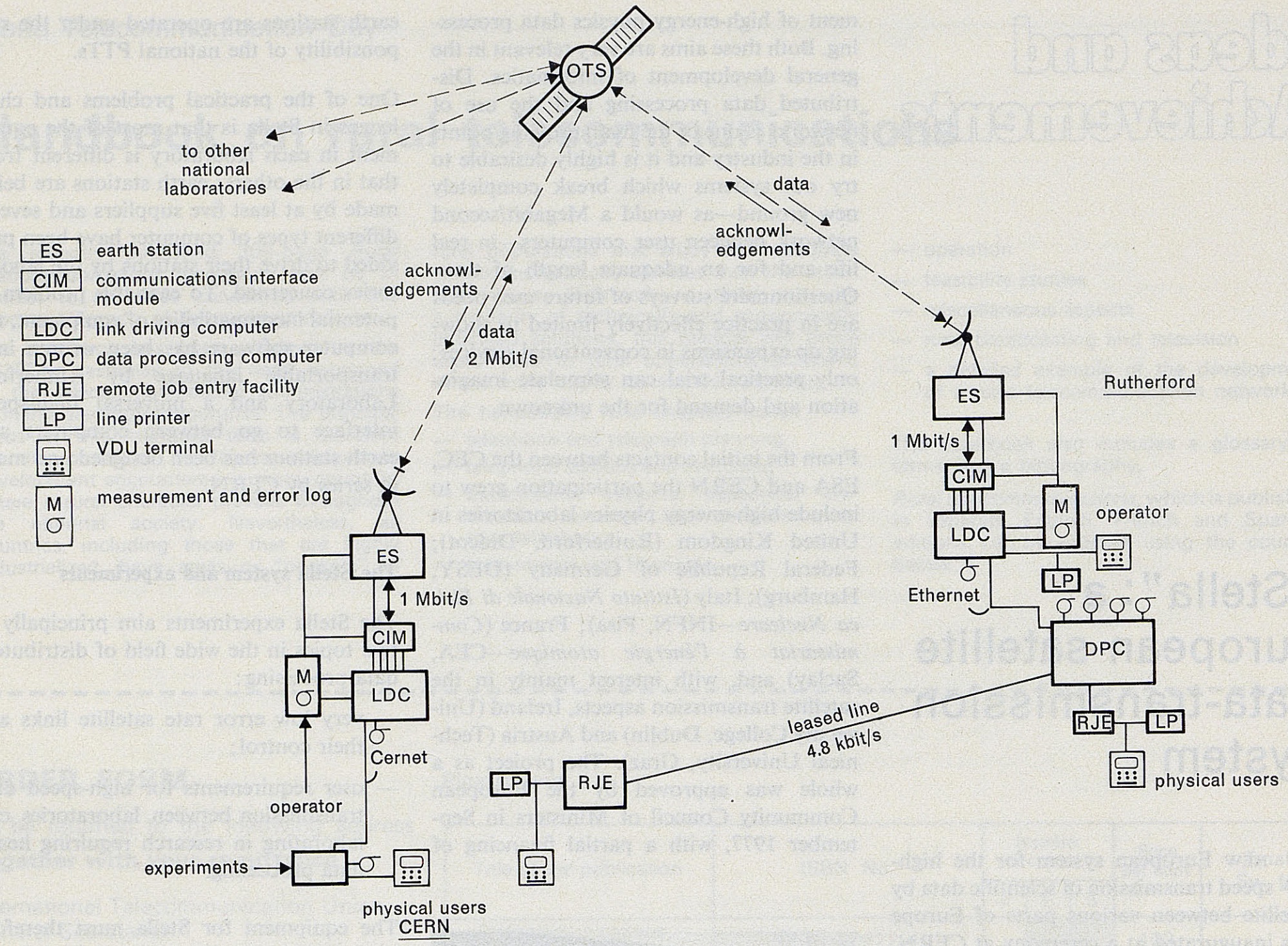


Figure 1

itself interesting research problems which may be taken up at a later date.

As shown in figure 1, the present physics data processing chain for the Rutherford-based experiments at CERN includes remote job entry stations in United Kingdom universities and at CERN, so that the United Kingdom physicists can use the large computers at Rutherford from a distance, provided the data and large analysis programs are already at Rutherford. New data and programs can effectively only be sent on tape or disc, taking days, if not a week or more. The Stella links are designed to remove this weakness and to make possible the transmission of fresh data, the computation and return of results within hours instead of days. Evaluation of this possibility and other operational improvement in actual practice is one of the main aims of Stella, using different groups of physicists from different home institutes and with different experiments to give a broad spectrum of opinion.

It is planned to send samples of physics data several times per day from CERN to the relevant home laboratories and possibly also larger quantities at night or at weekends. The physicists groups will record the use made of these rapidly sent data, to see what effect they have, in the course of several months running, on the relative use of computers at CERN and at home, on the movement of people, and on how far the physicists at home can participate more actively in helping to run their experiments. If such high-speed links would become generally available in long term, this might make significant differences to the way experiments were built and run and on how much physicists would have to travel and be absent from their universities.

The other aim of Stella, which is more technical, is to study transmission errors of all kinds and the efficiency of the error detection and correction mechanisms used. To this end, the local weather conditions (which affect signal strengths and error rates) and the earth station parameters will be logged continuously, together with the existence of any transmission errors picked up in the data. The data are sent by the "master" transmitting station up to the satellite in ISO HDLC frames each containing about 30 000 data bits at a rate of 15 frames per second. All the other, "slave", stations can receive the signals coming down from the satellite, whose beam covers all Western Europe, and can record the data on magnetic tape if the frames are addressed to them. They will send back short acknowledgement frames during time gaps between successive master station transmissions. The master station can therefore know if a frame of data has been incorrectly received and will retransmit it, if necessary several times. Errors in data are detected on reception as part of the HDLC transmission procedure, which includes a so-called cyclic redundancy check (CRC) on the data in each frame which is capable of showing up all the likely errors due to noise and disturbances in the satellite link.

The error rates acceptable in high-speed data transmission must be much lower than for, say, telephone calls or slow data; ideally a link should introduce no more

errors than a direct short distance connection, but practically a bit error rate of 10^{-9} or 10^{-10} would result in reasonably infrequent retransmissions. To achieve this performance, which is much higher than that of normal PTT lines or satellite circuits, the data are coded by doubling the number of bits transmitted, i.e. the satellite link works at 2 Mbit/s when the real data rate is 1 Mbit/s. On reception, the 100% redundancy allows very powerful error correction techniques to be used, which lower the overall error rate by a factor 10 000 or more. Stella incorporates a *Linkabit* coder/decoder to perform this function, and testing its real performance under a range of operating and weather conditions is one of the technical aims of the Stella programme.

The Stella system at CERN is typical of that in the other laboratories. The link driving computer is connected on one side to the CERN local network Cernet and on the other to the earth station via the special communication interface module. The LDC is a standard minicomputer with tape unit for holding data for transmission and disks for programs, status and error logging, etc. The CIM is connected directly to the LDC memory and contains a microprocessor with two main functions:

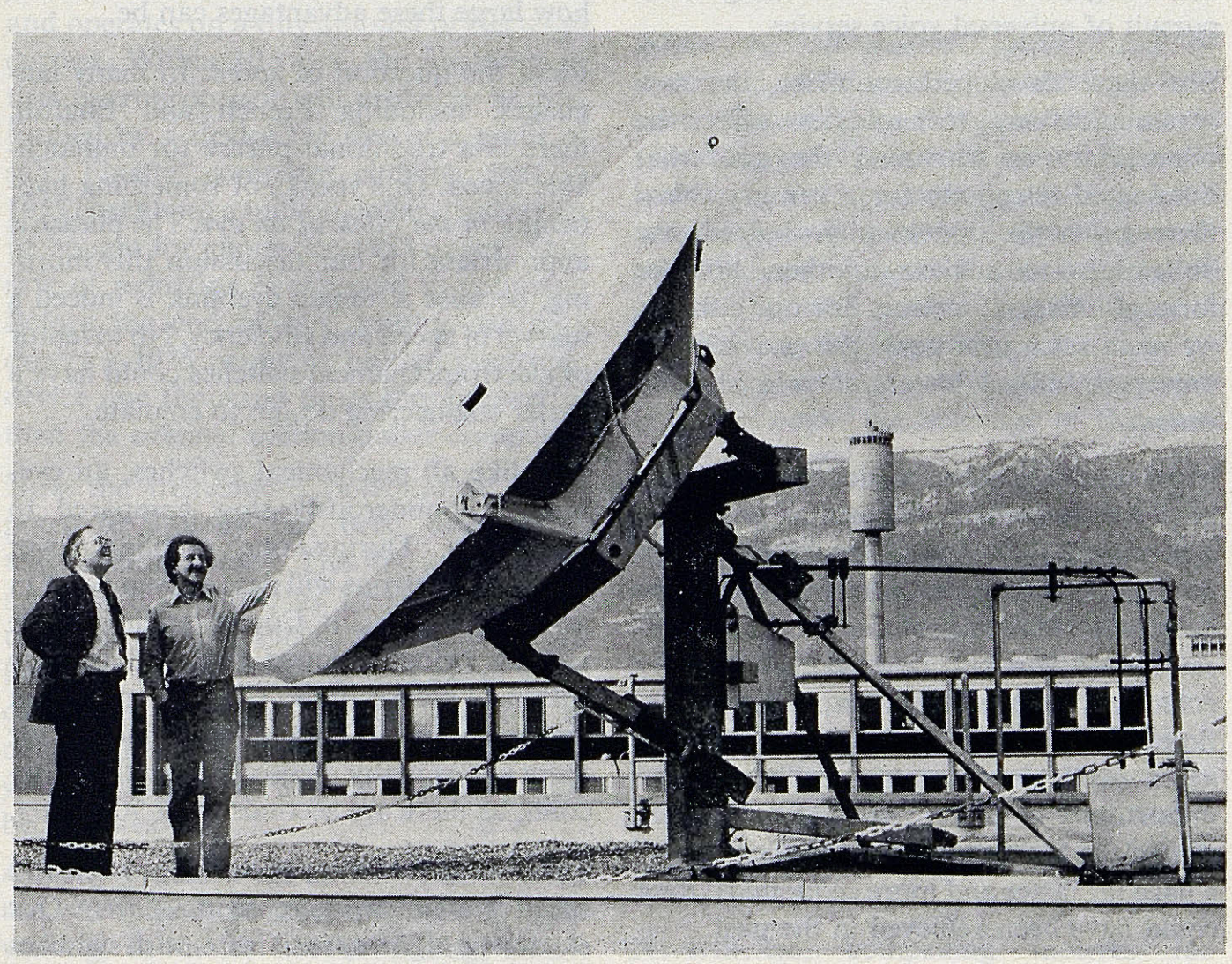
— control of the special hardware (an LSI chip) which, on transmit, takes blocks of data from the LDC memory, converts them to HDLC frame format and sends them to the earth station, and, on receive, performs the inverse operation including evaluating the cyclic redundancy check and signalling any errors;

— generating the critical timing functions to send and receive the data and to keep "slave" stations in step with the "master".

The CIM has been designed and made in small quantity by CERN for all the participants; its design is such that it was easily adaptable to several different makes of computer.

The LDC holds the software for the higher level transmit and receive protocol, for taking data to and from Cernet and the intermediate magnetic tape and for generally controlling the link, logging status and error information, etc. This software has been written in the transportable language BCPL by the Rutherford Laboratory. BCPL, partly as a result of wide usage at CERN and in other laboratories, is available on many types of computer and its use avoids a multiplication of software effort in Stella.

The earth station contains the Linkabit coder/decoder mentioned above, a burst modem to perform the pulse-to-70 MHz radio-frequency conversion, and then a conventional frequency changing system to the final transmit/receive frequencies of 14/11 GHz. The transmitter power output is about 100 W maximum and the receiver has an inexpensive but moderately low noise input stage. The overall performance with the OTS satellite is such that, given the theoretical performance of the coder/decoder, the required bit error rate of better than 10^{-9} should be achieved under most atmospheric conditions.



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Antenna installed at CERN, pointing to "OTS" satellite (CERN)

The Orbital Test Satellite

The OTS is an experimental communications satellite built by European industry on behalf of ESA. It was launched from Cape Kennedy in the United States on 12 May 1978 using a *TD 3914* launch vehicle. It is placed in the geostationary orbit above the equator at 10° E longitude.

The purpose of OTS is to act as a forerunner to the planned European Communications Satellite *(ECS)* system and to test the techniques and systems which the latter will use. To this end, the major part of the payload of the satellite comprises wideband (40 and 120 MHz) repeaters connected to high-gain, narrow-beam (7.5° × 4.25° and 2.5° × 2.5°) antennae. These are being used for trials of high-speed digital transmission, using bit rates up to 180 Mbit/s, and of techniques such as time-division multiple access (TDMA), digital speech interpolation (DSI) and frequency re-use by orthogonally polarized co-channel link transmission.

In addition to the wideband repeaters, OTS contains a multi-purpose narrow-band communications package, which is designed for use either in atmospheric propagation tests, measuring attenuation and depolarization of signals, or in narrow-band transmission tests, as for example digital data transmission tests between small earth stations such as are required for the Stella experiment.

Conclusion

Stella should transmit physics data between the laboratories involved at speeds similar to the working speed of the computers and thus eliminate the delays incurred when sending tape by post. Stella will therefore help to strengthen European physics co-operation and help other bodies involved to plan future projects in the field of European communications.

The Stella project is financed by the European Space Agency, the European Communities, the authorities of the countries concerned, and CERN.—*CERN/European Communities Geneva Office.*

Telecommunication service options and values with SPC and digital techniques *

by
Theodore F. BROPHY
General Telephone
& Electronics Corporation (GTE)
Stamford, Connecticut, United States

SINCE 1975, when this Forum was last held, telephony has entered its second century. Throughout its first one hundred years, it had relied upon a steady but relatively slow infusion of new technology. As a result, the world had witnessed strong but orderly progress toward what had always been the overwhelmingly dominant goal of our industry: global communication of the human voice. Electromechanical switching technology provided an important means to that end.

The mid 1960s, however, saw the first commercial installations of stored-program electronic switching. That was the first step in what may well be the most significant development in telecommunications since the work of Alexander Graham Bell. That development is the marriage of the telephone with the electronic computer.

In many ways, that marriage today is still only in its honeymoon. It is not inexpensive, nor is it without its difficulties. Like all great marriages, however, it is indissoluble, mutually beneficial, and will produce in the future new generations of services different from and greater than those that could have come from either the telephone or the computer alone.

In the Communications Act of 1934, the United States Congress issued a national mandate: the attainment of universal, affordable communication service. (At that time, of course, the focus was on *voice* telephone service.) Today, with more than 95% of our households having telephone service, the United States has effectively achieved that mandate. A number of other developed countries are at virtually the same stage, or at least are well along in the pursuit of universal voice service.

For these developed countries, the new communications technologies offer the opportunity to transcend the goal that dominated telephony for a century. Now there exists the opportunity—indeed, the obligation—to achieve another, broader form of universal service. For our citizens, we must set a new goal: the provision of universal, affordable *total telecommunications*.

Most countries in the world, of course, still have a considerable distance to go before achieving universal voice service. For them, the new technologies could prove to be even *more* advantageous. Older communications systems can now be economically enhanced, complemented, expanded, sometimes even replaced by the new. As a result, most developing countries will have the opportunity to achieve universal voice service of the highest technical quality, and at a pace far faster and more economical than could have been achieved in the past.

This new world of electronic switching technology offers at least seven irresistible advantages over the old electromechanical technology. It gives us enormous increases in speed, capacity, quality, and reliability, while offering us comparable reductions in size, consumption of energy, and total cost.

For those of you who, like myself, are not scientists, I would like briefly to suggest just how large these advantages can be.

First, the question of *speed*. In many languages, including French and English, there is a traditional phrase for unmatchable speed. One speaks of something happening *in the blink of an eye*. The phrase is appropriate for our discussion this morning, because a human eyeblink is indeed a marvel of speed and efficiency. No inventor of electromechanical switches could have a better engineering design to emulate.

Yet, like all mechanical switches, an eyeblink is ponderously slow compared to electronics. During one eyeblink, over 1 trillion electrons will pass a given point in an electronic circuit. Computer circuits are already being designed that will operate within 13 picoseconds. That is a speed that makes an eyeblink seem interminable, for there are as many picoseconds within 1 second, as there are seconds in 31 700 *years*.

Closely related to this enormous increase in speed is a similar increase in *capacity*. Our electronic highway is so fast—with switches operating like instantaneous interchanges—that there are virtually no limits

* This text was presented at Part 1 of the 3rd World Telecommunication Forum (Geneva, 19-26 September 1979), organized as part of TELECOM 79, 3rd World Telecommunication Exhibition.

o the amount or kind of cargo we can place on that highway.

In the same way, the improvements in speed and capacity brought by electronics also bring improved *quality*. We now can manipulate signals, on a real-time basis, so as to maintain or restore their original strength and character.

The other chief advantages of electronic technology are greater reliability and dramatic reductions in size, consumption of energy, and cost. All of these advantages are in stark contrast to the world of only 25 years ago, before the introduction of solid-state and integrated-circuit technology. In an article published in 1954, an American physicist argued that computers could never attain anything approaching human intelligence. He wrote:

"The human memory is a filing system with a far greater capacity than that of the largest thinking machine built. A mechanical brain that had as many tubes or relays as the human brain has nerve cells would not fit into the Empire State Building, and would require the entire output of Niagara Falls to supply the power, and the Niagara River to cool it. Moreover, such a computer could operate but a fraction of a second at a time before several thousand of its tubes would burn out and have to be replaced. One of the largest of today's computers, the *Eniac,* fills a large room, has about 18 000 tubes and has therefore about as many brain cells as an earthworm." [1]

Eniac, the largest of computers in 1954, can already be replaced by a single microprocessor chip the size of a postage stamp, which offers maintenance-free reliability and operates on a tiny amount of electrical current. Within 10 years, the functions of that microprocessor will probably be performed by a device the size of a grain of salt. Finally, computer circuitry that in 1955 cost about a million dollars, today can be bought for about one 1955 dollar. That rate of reduction is expected to continue. Before the end of our century, we may expect a 1955 penny to buy an electronic device one thousand times more powerful than the original million-dollar computer.

Now the tremendous potential of computer technology has been brought to telecommunications. The first commercial steps in that effort, as I have said, were taken in the mid-1960s. At that time, we began to see the first introduction of SPC, or stored-program control, to analog communications equipment. Within a few years, a whole new range of service options became available.

Already available on an economical basis are such options as speed calling, call-waiting, call-hold, call-forwarding, three-way calling, automatic identification, and call restrictions. Such options are not just frivolous conveniences. Many of these options can be of enormous help to individuals, to organizations, and to entire national economies.

For example, when callers try to reach a party who is either absent or already busy on the phone, considerable time and effort are wasted: unable to leave a message, callers must continue to call and recall until a connection is made. Unsuccessful call attempts add substantial costs to even the finest telephone systems. It has been estimated that in the United States, for one reason or another, 32 long-distance calls out of 100 are currently not completed. And out of completed calls, the caller reaches his target party only 35% of the time. A universally available, stored-message capability could eliminate tremendous economic waste: in the United States, the wasted callers' time alone has been estimated at about 200 000 man-years, or at least 2 billion dollars per year.[2]

Many applications exist for SPC-analog technology. This is particularly true for those countries that are still emerging as centres of commerce and industry. Typically, their existing telephone networks were established with a goal of providing voice communications at the lowest possible cost. As a result, they find themselves equipped with switching equipment unsuited for growth in quantity or quality of services. For such problems, the best practical solution is to introduce stored-program analog technology at strategic switching points in the public network.

While the commercial introduction of electronic SPC-analog switching into telecommunications began less than 15 years ago, it has been only within the last two or three years that we have seen the commercial introduction of *digitally* switched telephony. Digital is the process, of course, by which any kind of signal—whether representing voice, or music, or pictures, or data—is converted into bursts of digital code: the language of the electronic computer.

Some considerable impediments—both technical and economic—will prevent any overnight conversion to an all-digital world network. Chief of these is the existence of huge investments in analog-based terminal, transmission, and switching equipment already in place. Over 90% of the United States network now uses analog switching. A total conversion in the United States before the end of this century seems highly unlikely.

Nevertheless, compelling motives for accelerating conversion to digital will exist in many areas, particularly those with highly developed commercial centres. All-digital systems, by their very nature, have transmission characteristics superior to those of analog systems. Digital equipment is also more compact and cheaper to manufacture and to maintain.

But the most dramatic motive for converting to digital technology is its far superior ability to transmit messages *other* than voice: especially such demanding messages as data, word-processing and video. The United States market for such non-voice services should reach 1 billion dollars by 1984, and not too long afterward could equal the market of voice revenues—currently at 40 billion dollars.[3]

Of course, the use of digital need not await a full conversion to digital switching. For example, *Telenet*, a value-added network service that GTE has just acquired, utilizes a technique called "packet switching". Through its use with appropriate programming, data transmission terminals operating with different protocols and at different speeds are able to communicate with one another. Packet switching also assures an efficient use of transmission lines by allowing a number of customers to use the network simultaneously. The users' data are converted into coded packets, interleaved among each other, routed to the proper destinations, and then reassembled into decoded messages. Telenet now provides almost 200 United States cities with local dial-service access to about 300 customer computers. Internationally, it provides similar data communications between the United States and 22 other countries and overseas points—including Switzerland.

Together, the application of SPC and digital techniques will permit the fuller exploitation of *other* advanced technologies, including that of *communications satellites*. Already, satellites have done more than any previous technology to unite all the world's telecommunications—including the most remote and hitherto inaccessible areas. Yet I believe the potential of satellites has only begun to be tapped. Some recent experiments with small roof-top antennas suggest that this technology could soon revolutionize telecommunications in urban areas, as well as in remote regions. James Martin of International Business Machines Corporation (IBM) has estimated, in fact, that

"*one satellite,* using today's state of the art, could have enough transmission capacity to provide every man, woman and child in the United States and Canada with a computer terminal... *during peak hours.*" [4]

I must say that when I am confronted with such facts, I feel a certain sympathy with an American clergyman, the Right Reverend

Edward Arthur Burroughs who, in 1927, proposed that all scientists take a 10-year holiday, so that the world would "have a chance to catch up". In fact, I think today Reverend Burroughs would ask for at least a 20-year vacation!

But such a holiday from innovation would be no more desirable than it would be possible. We must try to catch up with the extraordinary communications capability that the new technology has made available to us. We must identify those services that will best serve our fellow man.

With the combined technological advances of stored-program control, digitalization, and advanced satellites, we will have virtually unlimited communications capacity at our disposal.

That means a dramatic range of new service offerings will arise: commercial options such as electronic mail, decentralized banking, and video-conferencing; medical and educational services; intelligent terminals for the office and the home, offering such prospects as electronic libraries and home entertainment facilities. Any limits to the list will come not from the technology, but from our own lack of ingenuity.

To me, all this suggests something of paramount importance for TELECOM 79. We are at a moment in history when, with total realism, we can plan a range of almost Utopian services. Yet, at this same moment, most of the world still needs and demands simple, basic, reliable voice communications.

Faced with that paradox, our responsibility is clear. We must ensure that *neither* the mission of bringing about the advanced potentials of the future *nor* the mission of providing the basic necessities of today is achieved at the expense of the other.

The desire for better telecommunications is universal. But the actual needs and priorities for service options are as varied as are the 154 countries represented in the International Telecommunication Union. Together, we must anticipate, plan, and provide those varied services that the people of this earth will demand from us over the next two decades.

The issues at stake are much too large for any single company or country. That is why I feel that the role of the ITU will become even more vital in the coming years. More than ever, we will need the voice of the ITU in three traditional areas:

- *First*, it must continue its strong encouragement of the adoption and application, *wherever appropriate*, of such new technologies as SPC and digital.
- *Second*, to further its goal of a truly global network, the ITU must continue to unify the providers of the varied systems, making certain these systems are mutually compatible.
- *Third*, the ITU must continue to adopt standards of system architecture that will alow an orderly *evolution* of systems. Just as we must not permit obsolete standards to block new technology, so we must not allow any new standards to force working systems of today into premature obsolescence.

But *finally*, I urge the ITU to go beyond these traditional tasks in voice and record communication that it has always set for itself. In the light of what the new technologies hold out as promise for the future, I urge the ITU to recognize that its mission must now include the furtherance of a universal, affordable, and global network of total telecommunications services.

To meet that challenge, I believe we must never forget that communication is more than a matter of technology. Because it is a profoundly human activity, communication always has dimensions that are economic, political, psychological, social and cultural.

It is an interesting historical fact that technological progress has tended to *surpass* the dreams of mankind. It is the *other* kinds of progress—the areas of economics, politics, psychology and social life—in which we often find a failure to move as far or as fast as we had hoped. It is on these obtacles, and not on any technological failures, that mankind's hopes have tended to come aground.

Yet, despite these obstacles, we must advance toward our goal of a global network. It is difficult to exaggerate what is at stake. Ours is a time marked by world-wide inflation and by the excessive consumption of non-renewable sources of energy. Conspicuous among the means to counter these trends is the technology of telecommunications.

It does not contribute to inflation. In terms of real spending power, residential telephone service now costs the average United States family less than half what it did in 1960, and less than 30% what it did in 1940.[5]

Telecommunications can help conserve resources. Over the last decade, a reduction of only 1% of United States business travel by air and automobile would have saved roughly 25 million barrels of fuel.[6] Savings of this kind could easily be made through the use of new business information systems now appearing. Note that the average United States telephone message requires an expenditure of energy equal to only one-half spoonful of gasoline.[7]

These are two of the reasons why I personally regard telecommunications as the essential infrastructure of the next century—comparable to the railroads and harbours of the 19th century and the highways and airlines of the 20th. By playing its proper role, the ITU can help ensure that all nations have a better chance to prepare themselves for that future.

It seems self-evident to me that important benefits to all humanity will flow from these new technologies. I know that technology has had its critics recently. Indeed, one school of thought would even have us believe that all inventions originally spring from *aggression*—from the desire to dominate and to destroy. Those of you who saw the film, *2001*, will remember that the first tool was supposedly invented when an apeman picked up a bone merely in order to have a club with which to kill his adversary.

Perhaps that is indeed the way it all began. But I prefer my own, quite different theory. I believe that first man picked up the bone and tried to *talk* into it. It was only after his first attempt failed, that he did what so many modern humans still do with non-functioning telephones: he turned it into a weapon. If I am right, the best deterrent to human aggression is improved communication services.

In the next few years, we can do more than has ever been done in history, to help human beings not to fight—but to talk and to listen and to learn.

(Original language: English)

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Strategies for dealing with an integrated world network*

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This paper focuses on the strategies for dealing with an integrated global telecommunications network. It provides an overview of the benefits of telecommunications to the people of the world and offers a review of the technological developments in international telecommunications over the past several decades. It also discusses international network management, alternate routing procedures and the requirements necessary for moving toward an international integrated network.

I. Introduction

My remarks today will focus on the *strategies* for dealing with an integrated global telecommunications network. Clearly, consideration of these strategies is needed more than ever before. The advanced state of telecommunications technology and the increasing demands of people everywhere for a variety of communications services have created a new global communications environment.

Therefore, we meet in Geneva at a unique time in the history of international telecommunications. As many of you realize, technology has virtually exploded during the last decade. And the developed and developing nations of the world are beginning to reap the benefits of that explosion in the form of improved and more innovative services at more attractive rates.

I believe we now stand at the threshold of a major transition—an evolution toward an international network that is truly integrated. The strategies we elect to pursue at this threshold point will determine how rapidly integrated world communications evolve.

Today I want to cover four broad areas that have brought us to this doorway to major change and unprecedented opportunity.

— I will briefly review the technological developments in international telecommunications history,

— and I will offer for your consideration what I believe are the key ingredients in developing and managing an integrated world telecommunications network;

— then, I will make some comments on the current political and regulatory developments in the United States that may have an impact on international communications;

— but first, I want to talk about what telecommunications progress has meant to the people of the world.

II. The benefits to people

The world has grown smaller rapidly in this century. A new world community has emerged with virtually every nation linked to every other nation by ties that grow stronger each day. In recent years we have seen evidence that nations share strong economic ties. Problems in a single country's economy can spread swiftly across oceans and continents.

But economic interdependence is only one of the many complex ties that today bind together the nations of this world. Steadily increasing commerce, the world food supply, and modern transportation developments are separate, but critical, links that are causing further shrinking of the world —and even more interdependence among nations.

As I am sure you recognize, the growing convenience and quality of communications have been key factors in creating and strengthening these international ties.

Voices and pictures move instantly over thousands of miles, bringing far-off events and remote places to our homes. We have seen the moons of Jupiter as well as the ocean floor. But the knowledge we have gained through communications goes well beyond current events and scientific novelties. The business world, for example, has benefited greatly from communications developments. And so have its customers. Progress in data as well as voice communications is helping businesses the world over improve their efficiency, their products and their services.

In addition, the educational benefits of modern communications hold a truly incredible potential. Developing nations, for example, can bring complex technologies to their people in a relatively short period of time. Communications are a key element in doing this. That is why many developing nations are formulating plans to improve communications in their countries. A sound telecommunications network is a solid foundation on which to build for the future.

But there are opportunities for developed nations as well. I will get to those in a few moments.

The progress we have made in international communications is significant. However, the world-wide telecommunications network that is still evolving holds even more dramatic promise—it will serve as a catalyst to vastly expand mankind's capacity to manage, to co-ordinate enterprises on an international scale with the same speed and facility as that now enjoyed domestically by the most advanced nations.

It is no longer an impossible dream to envision that one day virtually any one of the world's households might be connected instantly with any other. Such a goal is not beyond the scope of current technology. And I believe it is feasible administratively as well, particularly when you consider the outstanding co-operation among nations that has enhanced communications progress over the years.

III. Historical developments

The most visible aspect of that progress is the technology that has constantly perfected the quality, speed and flexibility of

* This text was presented at Part 1 of the 3rd World Telecommunication Forum (Geneva, 19-26 September 1979), organized as part of TELECOM 79, 3rd World Telecommunication Exhibition.

voice and data transmission. But, just as important, the history of telecommunications is a chronicle of co-operation among nations—a voluntary partnership that is perhaps unequalled in any other facet of global politics or sociology.

Transoceanic telephone service, the first major achievement of this partnership, began in 1927, a step ahead of Charles Lindbergh. The spirit of international calling across the Atlantic predated the *Spirit of St. Louis* by four months. Those who made calls on this first transatlantic radiotelephone route between the United States and London paid 75 dollars for three minutes. In today's dollars that 1927 call would cost 304.00 dollars. That same call today costs as little as 3.06 dollars.

For many years after that 1927 breakthrough, intercontinental communications grew slowly. The lack of good transmission facilities to span oceans presented an obstacle that took years of hard work to overcome.

Bell Telephone Laboratories scientists eventually eliminated this barrier by perfecting a vacuum tube for use in amplifiers that made undersea cable systems possible. By 1956 the first transatlantic cable was in service. For the first time intercontinental callers could communicate by voice as clearly across oceans as they could locally.

That first transatlantic cable, which was retired last year after 22 years of reliable, high quality service, provided 36 circuits. Continuing development over the years has made each succeeding transatlantic cable more efficient and higher in circuit capacity. The sixth transatlantic cable, which went into service three years ago, has 4000 circuits—more than twice the capacity of its largest predecessor.

But undersea cable research is far from over. We are now exploring the feasibility of an undersea cable system made up of optical fibres. Such a cable would need to be only about an inch in diameter. Yet its capacity would be about twice that of today's most advanced undersea coaxial cable. Tests are now under way to determine how this relatively new technology can be applied commercially.

Of course, cables are not the only means of international communications transmission.

In the early 1960s successful communications satellite experiments led to commercial satellite service. The International Telecommunications Satellite Organization (INTELSAT) has played a crucial international role—and the Communications Satellite Corporation (COMSAT) role as the United States representative has proved indispensable—in perfecting the commercial application of this space age technology.

With the addition of satellites, the foundation for an integrated international network had been built. And with international agreement on compatible signalling and development of a world numbering plan, subscriber dialling became possible.

In 1966 the first subscriber-dialled intercontinental telephone call was placed from Philadelphia to this very city. The recipient of that call was Jean Rouvière, then Director of the International Telegraph and Telephone Consultative Committee (CCITT). Four years later customer dialling was introduced commercially between New York and the United Kingdom.

Today, Geneva's citizens can dial 88 countries directly. And in the United States, 35 million customers can dial direct to 64 countries.

As important as these improvements have been, even more exciting developments are occurring in switching technology. Electromechanical switching systems were honed to near perfection in the years following their introduction. Then, in 1965 electronic switching came along. Its evolution has been rapid. Today's most sophisticated electronic switcher can handle 550 000 calls an hour—four times that of the most advanced electromechanical system previously used in the United States.

With the stored programme control capability that comes with electronic switching, it is possible to employ a system called common channel signalling. This system has a long list of beneficial features, including: faster call set-ups, improvement of routing efficiency, and the ability to carry a wealth of information along with a call.

In addition, quality of service improvements are being made on many technological fronts. I think the echo canceller is a prime example. This new solid-state device, designed for long-distance telephone service, removes the echo that accompanies voice transmission without affecting speech signals. This major breakthrough was made possible by large scale integrated circuit technology and its resulting high logic density in chip designs. These tiny chips replace three to four cabinets of equipment needed for today's less effective echo suppressors.

The technologies I have just mentioned are really only samples of what lies ahead. The pace of technological developments in telecommunications has picked up dramatically and, by all indications, it will continue at an even faster pace.

As I mentioned earlier, the progress we have made over the years in international communications could not have come about without a high degree of co-operation among nations. All the significant gains we have made stem from carefully worked out, mutually beneficial agreements among the world's telecommunications entities.

I think some of the key developments are worth reviewing: the international numbering plan, for example. And the CCITT No. 5 signalling system (which paved the way for international subscriber dialling). And CCITT No. 6, international common channel signalling.

But to me, one of the most significant international efforts in recent years is not an agreement. It is a test—the CCITT's field trial of international network management.

And that brings me to what I believe is a most important decision: one that lies ahead—an agreement on international network management. For without worldwide co-operation on this issue, an integrated world communications network cannot efficiently evolve.

IV. International network management

The rapid growth of the world's individual telecommunications networks was brought about by demand for services that were continually improving in quality, usefulness and value to the public.

International subscriber dialling is a current example of a service improvement that is generating increased usage. Our experience in the United States has been that when subscriber-dialled calling is available in a country, traffic volumes between the United States and that country rise substantially.

Telecommunications users respond to good service and they are constantly on the lookout for a wide range of new service offerings.

I think it is worth noting here that communication today takes many forms—not only speech, but pictures and data as well. These new forms of communication are

growing rapidly, not only within our countries, but between nations and continents.

The growth of non-voice communication will only add to the international telecommunications traffic that is growing dramatically every year.

By reviewing how we have managed the international network in the past, I think I can demonstrate why we need to move toward more sophisticated network management techniques in the future.

Before subscriber dialling came along, telephone operators throughout the world served essentially as total network managers. They manually recorded information to route and bill the calls. If the trunks were busy, they would tell the caller to wait, and then call back when a circuit became available. The operators could limit the number of attempts made on a given trunk, or they could route a call via a third country and duly record the routing information so that the transited country could get remuneration for the use of its facilities.

But customer dialling changed all this. Suddenly operators were no longer involved in that traffic. Subscriber dialling gave customers better service, and eliminating the operator made each call less expensive. But to a certain degree, telephone entities lose control of their networks. Without the operator controlling the traffic, callers are free to dial without control, sometimes causing switching and trunk congestion.

This was a problem the United States domestic network faced in the early 1960s. In those days the United States network generally operated in a point-to-point arrangement, much like most nations have today. As customer-dialled traffic underwent rapid growth, we found that many unusual events could snarl traffic over large areas. A mass calling incident in Detroit during the 1960 presidential election campaign, for example, brought nearly all telephone traffic in the entire city to a standstill for two hours. Several natural disasters caused similar problems the same year.

We were forced to institute a system of network management—a mechanism that allowed us to see where the congestion was occurring and deal with it in order to maximize call carrying capacity.

The international network today is susceptible to some of the same congestion problems. But we cannot overcome such technical problems until we face the challenge of planning an integrated world communications network.

I believe we have taken the first step in the planning phase with the Recommendation developed by a CCITT Study Group which carried out the international network management studies and field trial. For example, we now have a working definition of what international network management is.

The Recommendation refers to network management as: "supervising a communications network to ensure maximum utilization under all conditions. It requires monitoring, measuring and when necessary action to control the flow of traffic".

Network management is, in a nutshell, control. It involves the knowledge of when and where congestion exists, the capability of alternate routing—which allows idle circuits to be used. And it involves protective controls, such as call blocking—which, besides keeping circuits open in a disaster area, also stops attempts which are not likely to go through, thereby boosting network efficiency.

A few countries have network management. Without such control it is almost impossible to know how many attempts are being made on a given group of circuits compared with how many get through. Having this kind of information makes it possible to determine with greater precision new facilities construction requirements. Without the data network management provides, it becomes extremely difficult to discern problems in one's network—and therefore vital network management actions to correct serious problems are delayed.

I believe that if the amount of international traffic that is not getting through were known, we would be greatly surprised. I say that because of our experience in the United States. Not long ago, when we sat down to plan our switching systems, we paid little attention to international traffic volumes. As a result we later found that international traffic was causing congestion in our networks. Today, I can assure you, we definitely consider it in our planning process, and for a good reason—traffic volume.

For example, last year 140 million international calls went in and out of the United States. That is an increase of 29 % over the previous year. Next year we predict over 200 million international calls.

I strongly believe that this kind of growth has to be having an impact on most other nations' networks too. And without an international network control system, international callers may be in for a lot of busy signals.

There are a number of factors that stand in the way of moving toward international network management. But the two major needs are compatible hardware and a stored programme control capability. The proper switching equipment, or modifications to existing equipment, and the software needed for network management are expensive. But, according to the latest figures I have come across, nations around the world are spending more than 25 billion dollars a year on capital investment for telecommunications networks. By channelling some of this investment toward the integrated network goal, network management can be realized in the near future.

I realize that many telecommunications people are sceptical about the return on investment necessary to provide network management. I submit that the investment will more than pay for itself—even if international traffic volumes do not grow at the rate predicted. For, if networks are managed to allow the greatest number of calls to be completed, telecommunications investments will be more effectively utilized. It is fine to believe that the caller who gets a busy signal will call back later. But I personally believe that constant frustrations will turn that "later" into "never".

But even if economic considerations were an obstacle, I would still encourage a move toward network management, because it brings better service to international callers. If congestion on individual networks is not managed properly, the problem will spread throughout the entire network—in an extreme case, virtually bringing both domestic and international calling to a halt.

I do not suggest that international network management needs to be tailored after the complex arrangement of the United States public switched network. Such complexity is not needed for an effective integrated international network. For example, I do do not believe one central international network control point is necessary. However, I do believe a centralized system of gathering and exchanging international traffic data *is* needed. This would require each country to develop some kind of network control mechanism.

V. International alternate routing

What I am suggesting is nothing radical. Many nations have already started down the road toward mutually beneficial ar-

rangements to share facilities to take advantage of alternate routing. The first such arrangement, the Frankfurt pool, was made up of Germany, Belgium, Switzerland and the Netherlands. These four countries operated their networks in the pool from 1963 until 1976, when the circuit groups grew too large to achieve significant further economy through use of the pool.

Another such arrangement, the Nordic pool, has been operating since 1970. Sweden, Norway, Denmark and Finland are using the alternate routing concept to get the most from the total circuits available in their networks.

And, two years ago, several countries in the Pacific agreed to alternate routing procedures in order to reduce the call congestion to specific countries.

The only problem encountered by countries in these shared facilities agreements involved settlements. Revenue division does present a problem in any shared facilities situation. But I believe that plans are being worked out to make such arrangements attractive to all parties. For the international network to become more flexible, this problem will have to be overcome.

Before I move on, I would like to make a few comments on the CCITT international network management field trial I mentioned earlier. The trial, conducted among 13 nations, ran for five years. Basically, it was established to pinpoint the criteria for making network management actions necessary. The countries exchanged data on traffic over certain trunk groups and made known to one another any unusual occurrences that led to network management actions, and, of course, what the effect of those actions was.

The trial produced a lot of data that has enriched our knowledge of what we can expect in dealing with an integrated international network.

I think the trial proved that there is no such thing as an average day in managing and operating a complex telecommunications network. And that is what every nation's network is becoming, or has already become—*complex*. There is *always* a condition that needs attention, a condition that is beyond the capability of a single computer or a single operator.

I have already covered a few of the benefits of international network management: providing better service, relieving congestion, and increasing revenue. The desire to do the latter is at the very heart of any enterprise. To have good service you have to have good earnings. And I do not believe this is any less valid here in Geneva than it is in the United States. Of course, generating revenues is not, nor should it be, an end in itself. The real objective of revenue generation should be service improvement, and that means capital investment.

I would like to make one more observation before moving on. Network management on an international scale will bring people of all nations together in a common mission. It will encourage them to share ideas as well as information. And it will mean closer working relationships than ever before in the process of finding solutions to common problems.

VI. The United States regulatory/legislative scene

Now I would like to turn to the current political and regulatory situations in the United States that could have an impact on international communications.

As many of you are aware, the future direction of telecommunications policy in the United States is currently under review in the Congress. The result of that review could produce a United States telecommunications industry substantially different than it has been for the first 102 years of its existence.

The Bell System has not been silent on the issues facing the United States telecommunications industry. We have vigorously expressed the view that our public switched network, in order to work as one, must be planned and operated as one.

One fact is absolutely clear. Competition will be much more intensive in the domestic portion of the industry. And this trend could ultimately affect the international arena as well.

The Bell System clearly recognizes this reality. As a result we are looking at the world much differently now than we have in the past. One of the most important responses we have made in this new environment is an organizational realignment along market segmented lines. This move has made us better able to anticipate the needs of our customers as well as serve them more effectively. In addition, our new structure places us in a stronger position to provide and improve services for our customers.

But, no matter how effective these internal efforts prove to be, United States telecommunications policy will determine the ground rules under which we in the Bell System will be operating in the years ahead.

As I indicated earlier, the intensive review of the telecommunications industry by the United States Congress also involves international communications. Of course, no one can predict what the outcome will be be. I would hope that when a new policy evolves, the interests of the telecommunications customer will be well served. That, in our view, is the *prime* consideration.

Now I would like to comment on the United States regulatory environment. In recent years, I must confess, the United States has been a difficult telecommunications entity for nations to deal with. I know that some people in this room today have shared with me the frustrations brought about by United States regulatory policy—such as the costly delays we in the Bell System and our American and overseas partners have experienced in the area of facilities construction for overseas service.

But, despite having said that, I think that in the past year significant progress has been made toward solving some of these problems. And I believe the single most significant factor in this progress has been the efforts of the foreign telecommunications administrations to make their views known to those who formulate policy in the United States.

For these and other reasons, I am optimistic about the future. The entire direction we seek in our respective countries is a planned strategy to help us meet the needs of our customers.

VII. Conclusion

In conclusion, I would hope you agree that there is a compelling need today, as we plan for the future, to move quickly toward a system of international network management.

By doing so we will serve our customers better, meet their needs more effectively, generate more revenues—which will give us more opportunity for investment—and finally, in doing so, we help strengthen those links that are tying the world closer together.

For the Bell System's part, I can assure you that you have our full support. We will do whatever we can to enhance the evolution of an integrated world communications network.

It was with that in mind that I came to this beautiful and historic city.

(Original language: English)

Effect of technical innovation on the choice of systems: economic benefit from the introduction of TDM switching *

by

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SUMMARY

This article attempts to describe the contribution that the spectacular technical and technological innovations which we are now witnessing can make to the development of our telecommunication media.

Particular emphasis is laid on the substantial economic benefit to be derived from the introduction and widespread use of digital techniques in both switching and transmission and their foreseeable effects on the development strategy applied to telecommunication networks.

1. Introduction

MEN have at all times tried to break the bonds of space and time by developing their means of communication. In the course of the long evolution of mankind, technical progress has played a decisive role in this development, and the emergence of electrical communication media in the last century was an event of paramount significance.

The dramatic advances that we have witnessed over the past few years have enormously speeded up the process of development of these communication media at a time when, as the result of sociological and economic pressures, both individual and collective requirements call for more strenuous efforts aimed at their dissemination and diversification.

Since this effort means considerable investments, it is absolutely essential that the basic options for the architecture of these media should be chosen with an eye to the optimum use of the financial and human resources committed.

Certain technical formulae seem to be more suitable than others for the solution of a given development problem at a given time and for a given period, for example, the so-called digital structures used for the generation, transmission and reception of data-carrying electromagnetic signals.

This system, which is both technical and technological, appears as the convergence of three trends:

— increased demand for communication,
— advent of new theoretical signalling concepts,
— technical and technological advances in the processing and transmission of signals.

The increased demand for communication is obviously linked with the development of the telephone and telex, but a telecommunication infrastructure should also lead to the introduction of facsimile, data transmission and home access to data banks.

Technical and technological progress has been reflected in the emergence of theoretical signal processing concepts and the development of the electronic components used as building-blocks for the assemblies and sub-assemblies of telecommunication equipments.

At the level of theoretical concepts, research has learned to consider time not as a master but as a parameter to be exploited.

The first step consisted in saving time. It became evident that there was no need to total up the values assumed by a quantity in the sum of real moments in order to retrieve the information that this quantity contains as it varies in time. Sampling thus leads to an appreciable time saving, the remaining intervals being used in turn for the analysis of one or more quantities.

In the second stage, a considerable advance was made in that the signal quality was given a large measure of immunity to the vicissitudes undergone by the signal during the innumerable conversion processes to which it is subjected between emission and reception.

These processes affect the basic characteristics of the signal—amplitude, phase and frequency difference—all of which are eminently analog quantities. When the data content was shifted to the time parameter by coding, the signal was rendered much less vulnerable to the effects of these operating processes.

It was precisely at the time when data were being coded into binary form that enormous advances were made in the technology of passive and active components, also based on binary logic.

This coincidence is worth mentioning, since the introduction of digital techniques and the designing of the matching transmission and switching equipments would have been considerably compromised if integrated logic circuits had not been developed at the same time.

The recent emergence of integration techniques leading to high-capacity memories and to microprocessors has further boosted the potential of these equipments,

* This text was presented at Part 1 of the 3rd World Telecommunication Forum (Geneva, 19-26 September 1979), organized as part of TELECOM 79, 3rd World Telecommunication Exhibition.

with the undeniable result that digital networks represent an economic solution to the problem of telecommunications, since digitization of transmission arteries makes for much cheaper cabling and civil engineering works. The limit of the range of capacities below which the economic balance is positive is steadily rising. Hence the rate at which the inter-exchange interfaces of large urban networks and of the suburban periphery are digitized is bound to speed up over the next few years.

The intelligent use of an existing network can already lead to extensions at the lowest cost, involving savings of 30 to 50%.

The subscriber line distribution network, accounting for over 50% of the total telecommunication investment, should also be gradually absorbed by digital structures, which are drawing closer and closer to the telephone set itself.

The long-distance network will not be left behind in this evolutionary process. Digitization of this network seems to be inevitable, although it will probably come later.

While development of network nodal points is taking place in an environment in the process of digitization, it is impossible to conceive, without high-cost interfaces, of any alternative to switching at the level of the basic components of the generated and transmitted signals, or time-division multiplex switching. This switching method, the intrinsic cost of which is constantly declining, thus seems to be an inescapable economic adjunct to digital transmission.

These integrated digital structures also allow for flexible programming of service operation and for wide decentralization of certain decision functions through the use of microprocessors in increasingly dispersed units.

This makes for a better general economic balance of the network by lowering the fixed costs of nodal units and a reduction of the load on, and hence the cost of, the artery network.

Among the assets on this balance sheet, we should not forget all the possibilities for new services opened up by digital signals, by removing the many obstacles that the continuance of the traditional analog network would place in the way of their introduction.

The base signal (transmitted at 64 kbit/s) will serve as common denominator for routing along the network the telex, telephone, data and facsimile signals which account for practically the entire telecommunication sector.

Once telephone sets are digitized, the technical and technological revolution of the entire network will be completed.

The fact remains that the very large majority of existing networks still have an analog structure, using space-division switching. Confronted by the spread of digitization, users may be legitimately concerned about the compatibility of analog networks using space-division switching with digital networks using TDM switching. In our opinion, there is no cause for alarm. With the experience of over 3 million TDM lines ordered, of which some 1.5 million are operational in various countries where traditional networks exist, we can claim that the flexibility of the hardware and software used in digital networks makes them eminently adaptable to more rigid structures, an extreme case being that of networks consisting of direct selection switching units.

This flexibility also promotes the harmonious development of the network by making is it possible for obsolete equipments to be scrapped when their period of useful service has expired, without involving costly repairs.

I shall now go over the salient characteristics of digital systems, from the technical as well as the economic and industrial standpoints, outlining their foreseeable effects on the strategy of development of telecommunication networks.

2. Integrated digital networks

First of all, the introduction of digital techniques in telephone networks dates back to the 1960s with the 24, 30 or 36-channel PCM transmission systems; it was not until the early 1970s, however, that there was a substantial expansion of these short-distance transmissions (usually 10 to 30 km) using the existing infrastructure (audio-frequency cables). The idea of basing a switching system on the digitization of telephone signals gained currency in the late 1960s. This interest was evidenced by the number of specifications for 30-channel primary multiplex discussed during this period by the International Telegraph and Telephone Consultative Committee (CCITT) and the European Conference of Postal and Telecommunications Administrations (CEPT). Nevertheless, there were few laboratory assemblies available at that time and the first automated TDM switching equipments to be commissioned in a public network were introduced in France in 1970. Trials continued until 1973, when a reliable product of settled design enabled industrial manufacture to start up gradually.

Digital transmission continues to develop "independently" along two lines:

- cost reduction of primary systems on symmetric pairs,
- development of medium-capacity systems.

The first line of development involves accelerated and general expansion of digital transmission in its original sector (suburban and local networks); the proportion of digital circuits in large towns reached levels of 10 to 15% by 1976, about 25% being envisaged for 1980, discounting all effects of TDM switching.

The development of medium-capacity transmission systems will widen the domain of digital transmission to regional links and to the transmission framework of big cities.

This process will alter the transmission infrastructure: digital transmission will no longer be regarded merely as a means of ensuring a return on an existing investment. New investments in infrastructure are conceived with a view to immediate or eventual digital use, which involves, in particular, a reduced use of audio-frequency cables.

At the same time, the diminishing cost of components and the mastery of the technical, industrial and operational problems of TDM electronic switching lower prices sufficiently to make this technique competitive with space-division techniques, even if integration is not immediately within reach. TDM switching is therefore not restricted to particularly favourable specific cases, but is becoming a generally usable technique; operators and designers alike are becoming very rapidly aware of this, with a resulting avalanche effect; the assurance of competitiveness in switching has led to greater competitiveness in transmission, thus accentuating the trend towards digital techniques in decisions on infrastructural investment.

Among the practical manifestations of this avalanche effect, mention might be made of:

- the first orders placed for TDM switching equipment in France (1975),
- the generalization of TDM developments among all manufacturers, particularly among the suppliers of independent operating companies in the United States (1976),
- the results of international calls for tenders in 1978 and 1979, when business competition very soon focused on digital switching systems.

2.1 Architecture of integrated networks

Let us first examine what the introduction of digital techniques yields in the way of new factors in the structure of telecommunication networks.

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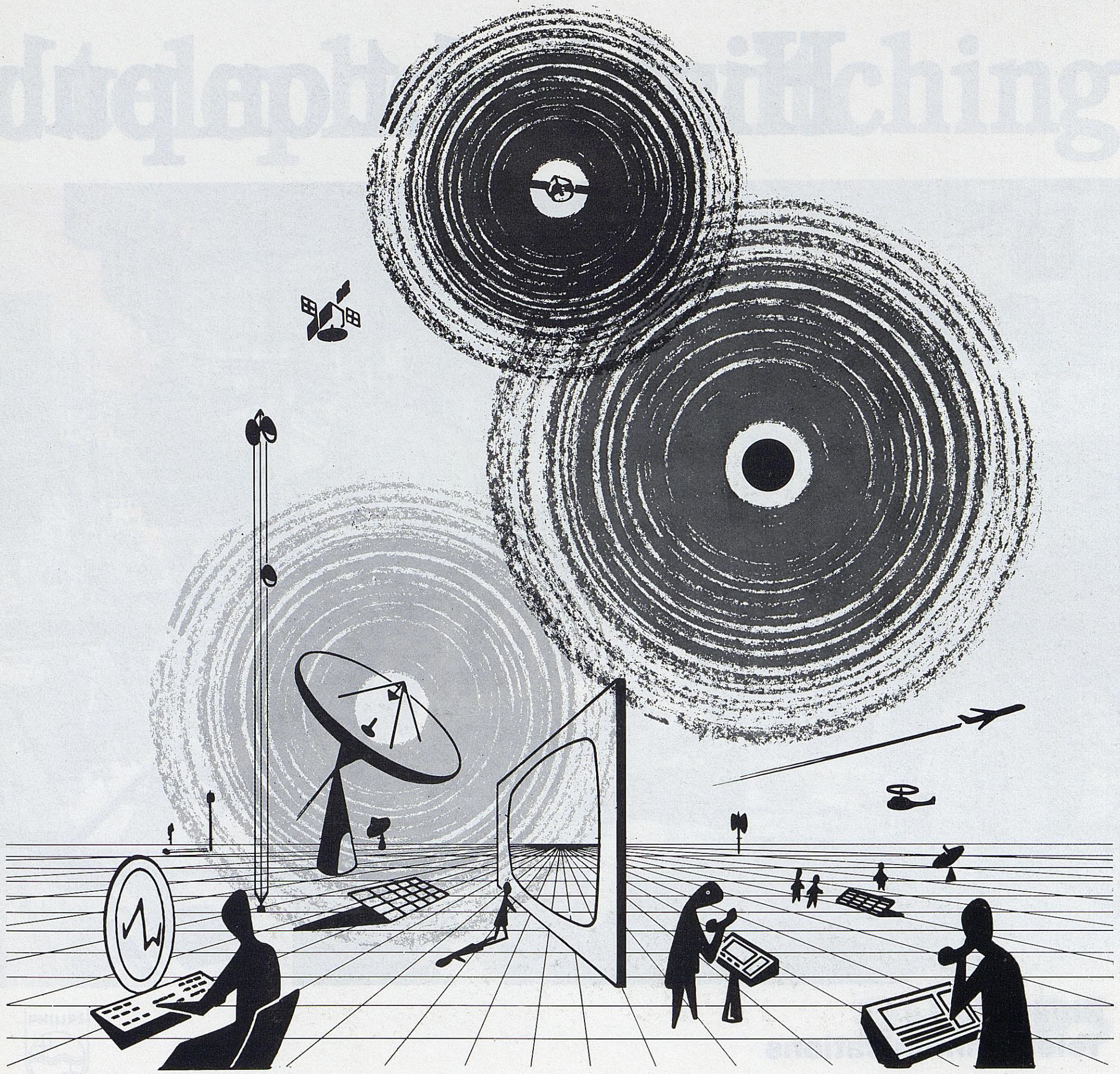

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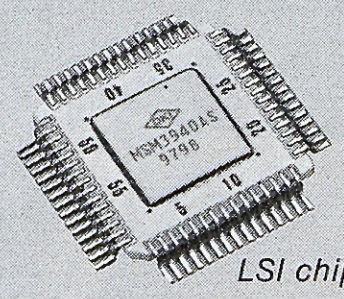

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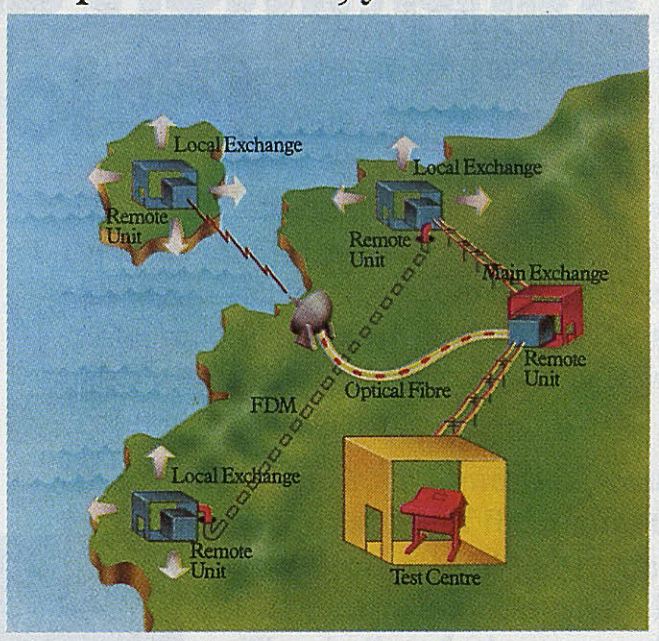

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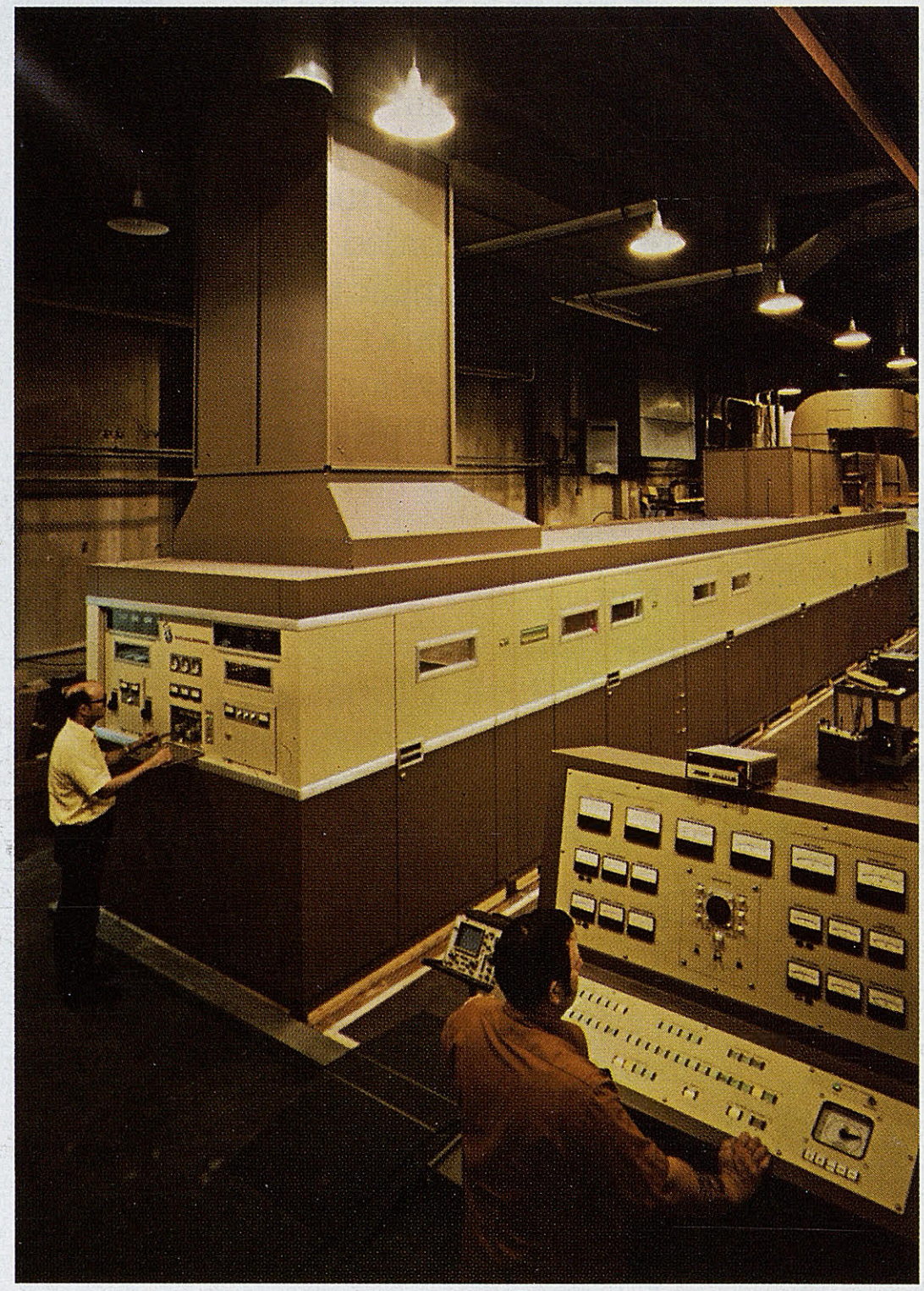

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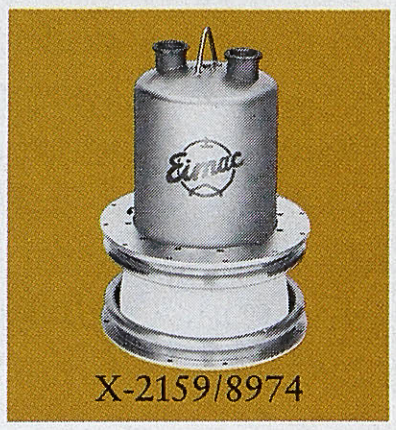

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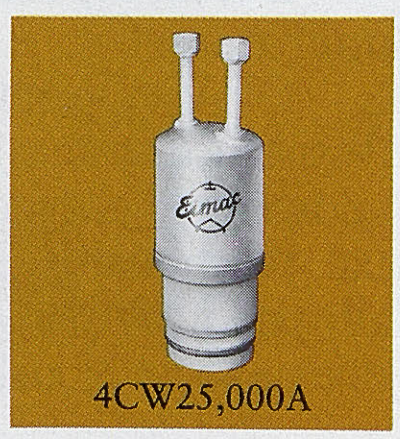

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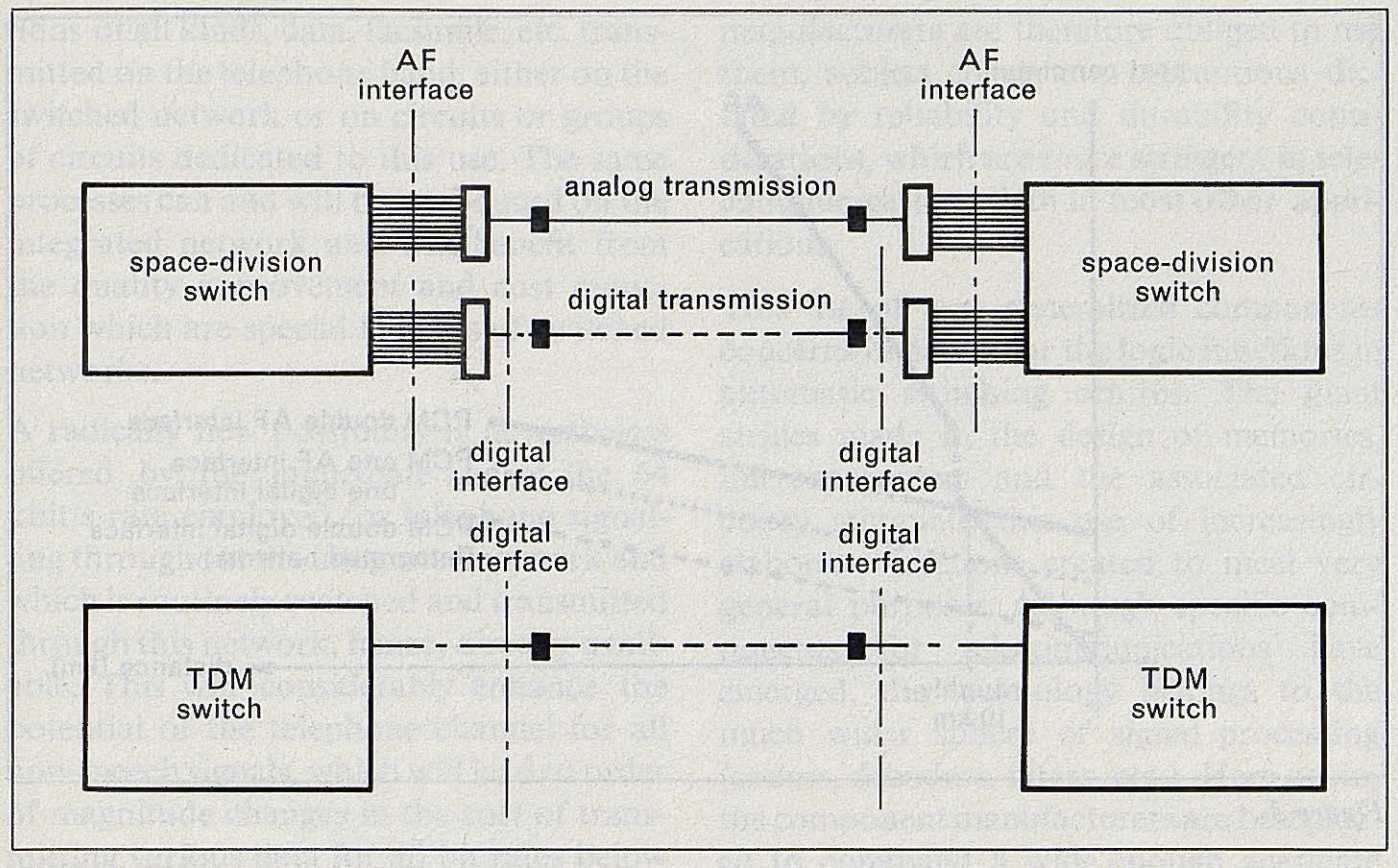


Figure 1

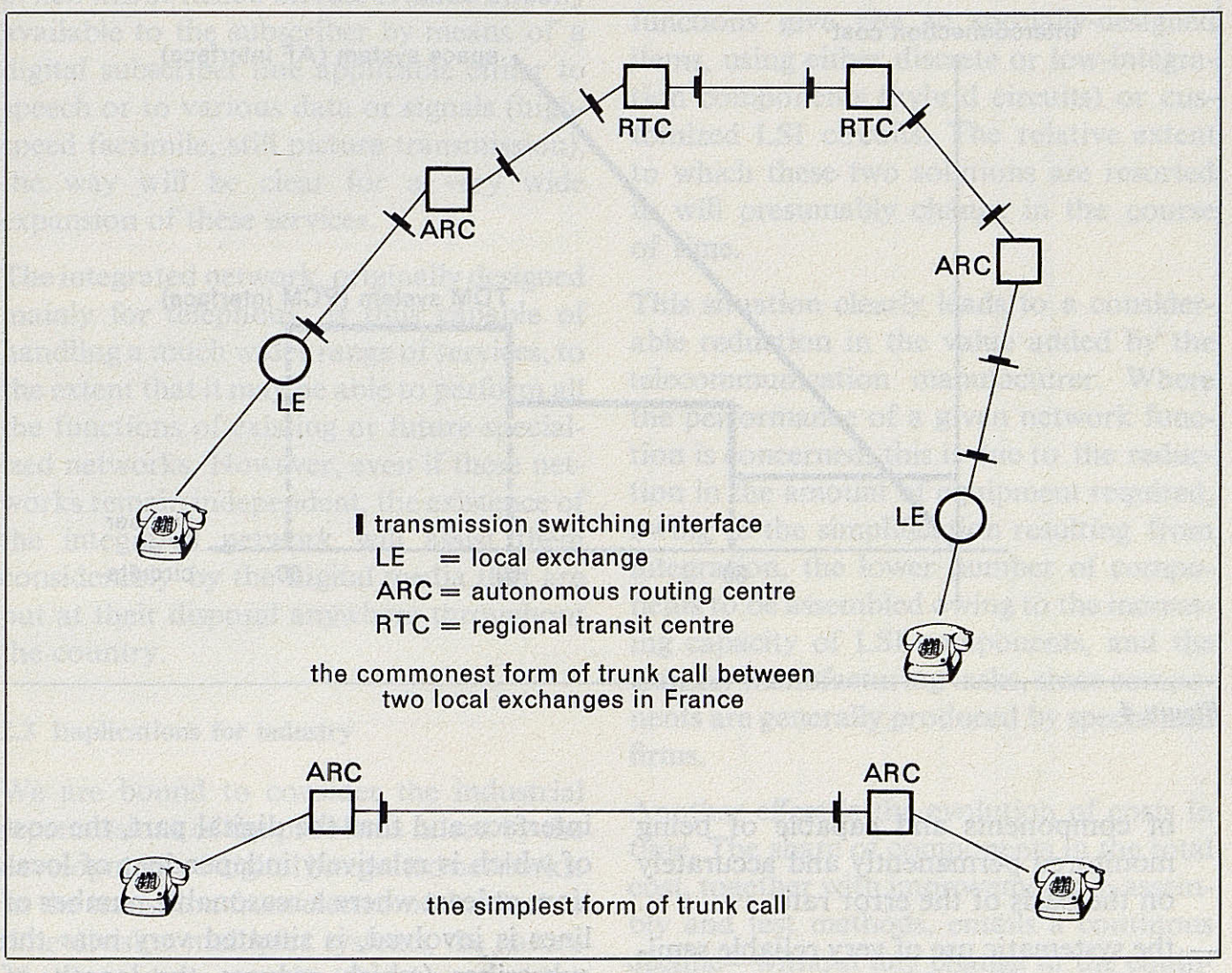


Figure 2

The fundamental aspect of integration, which may be deduced from the term itself, consists in the fact that the transmission media and the automatic switching equipments operate on *the same basic element*, the primary digital multiplex as standardized by the CCITT, in the 24- or 30-channel version.

The essential economy of integration lies in the possibility of direct interconnection of automatic switching equipments without the interposition of terminal equipments (analog or digital). This situation is illustrated in figure 1.

In a partly integrated network these terminal equipments will remain at the boundaries between the integrated and non-integrated parts of the network.

Dispensing with terminal equipments at the switching/transmission interface can lead to very large savings, since a trunk connection in a medium-sized country can entail the use of 4 or 6 interfaces of this kind (figure 2).

These terminal equipments no longer exist in totally integrated networks.

A convenient way of bringing out the effects of this phenomenon on network cost structure is to represent, on the one hand, the pattern of circuit costs as a function of distance and type (analog or digital) and, on the other hand, the trend in the cost of interconnection between adjacent exchanges as a function of the number of circuits required and types (figures 3 and 4).

These curves immediately show that in an integrated network the distance and complexity of interconnection of the network (number and size of automatic switching exhanges to be interconnected) become quite secondary cost factors, at least in cases where the distances remain below several tens of kilometres.

This pattern of interconnection costs is explained by the nature of the digital technique: interconnection and branching in the connecting network are logical, cheap processes. The bulk of the cost of an automatic switching equipment is accounted for by the non-logical part—the interface with the subscriber line and the analog-to-digital conversion. The signal coming from the subscriber must pay an "admission fee" enabling it to be switched and transmitted cheaply in the digital integrated network.

A noteworthy feature of this change in the relative orders of magnitude of the different functions is that of transit; in a transit centre, the "interconnection" function is an important part of the whole. With TDM switching in an integrated network, however, the transit cost plummets compared with that of the space-division technique, since the "admission fee" has already been paid in the subscribers' automatic switching exchange.

The implications for local network organization and distribution are clear: the domain of the metallic subscriber line is substantially reduced by installing, as near as possible to the subscriber groups, decentralized units of the TDM exchange, or small-scale TDM equipments or even digital subscriber multiplexes; these three options are technologically very similar.

This trend towards shortening metallic subscriber lines will also appear in medium population density areas and large cities. For reasons of distance or of subsoil congestion, distribution always accounts for about half the total network investment. In large cities, distribution can be reduced simply by using fairly small and hence relatively numerous automatic switching exchanges, which can thus be dispersed according to subscriber density to minimize connection costs.

This arrangement is generally inapplicable in space-division switching; here it takes the form of a large number of small and, hence, low-capacity inter-exchange groups,

or of massive recourse to urban transit—both solutions which in the space-division technique carry heavy penalties in the shape of extra interconnection costs. That is why the space-division solution leads to the establishment of very large automatic switching exchanges servicing a town with a handful of exchanges interconnected two-by-two by big groups. The small number of exchanges inevitably causes a lengthening of subscriber lines, hence, a more expensive distribution network.

With the digital solution, on the other hand, the possibility of cheap interconnection and low-cost transit can tolerate a large number of low-capacity groups and/or the use of transit to handle a high proportion of the traffic. It is thus possible to assist the distribution network by using a larger number of smaller automatic switching centres—20 000 to 40 000 subscribers being a reasonable figure.

It also means greater security for the network as a whole.

The repercussions on the trunk network also derive from the facilities offered by cheap transit; the general network organization gains in flexibility, since the economic balance struck between circuit performance and transit volume is shifted in the direction of a more liberal use of transit. As a rule, the necessary investment for the handling of trunk traffic is less than that required for a traditional network combining space-division switching and analog transmission.

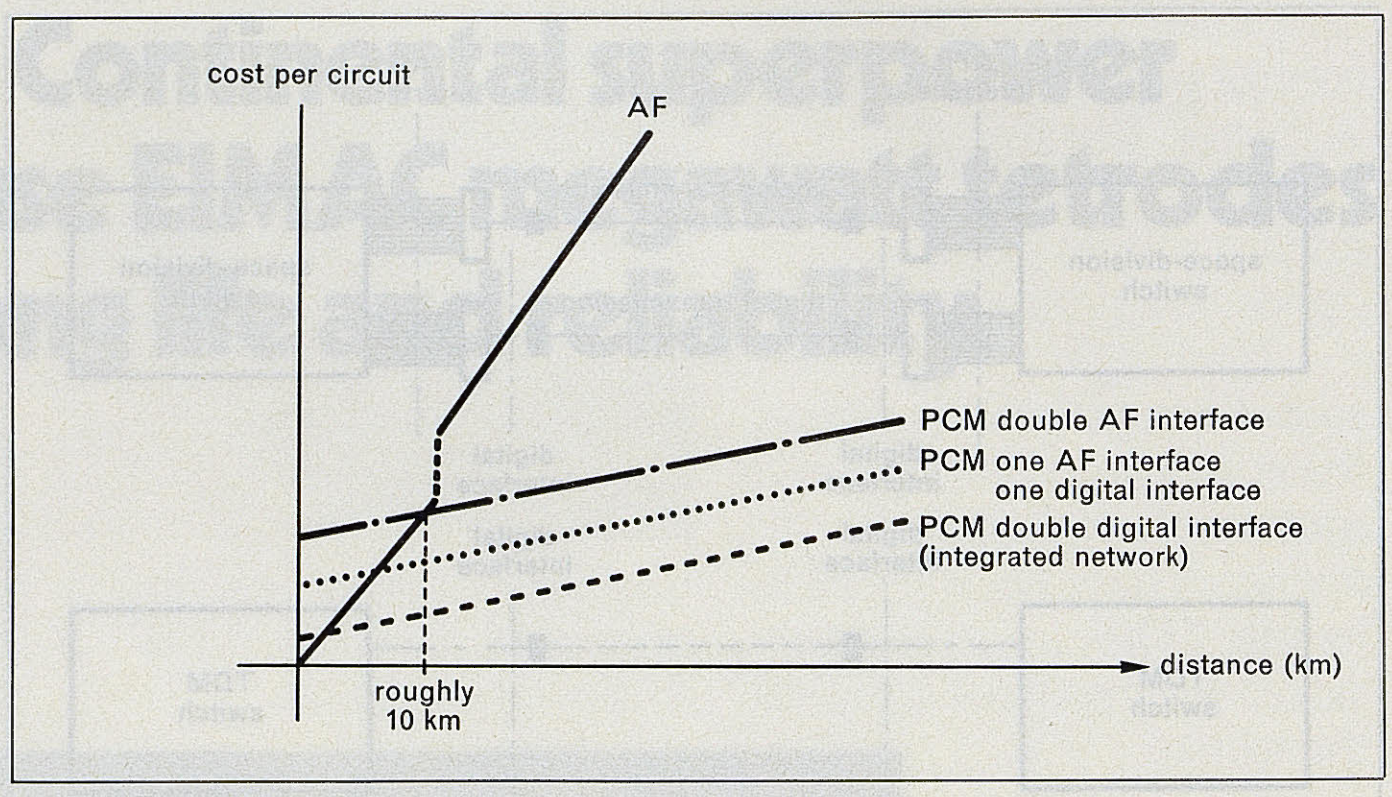


Figure 3

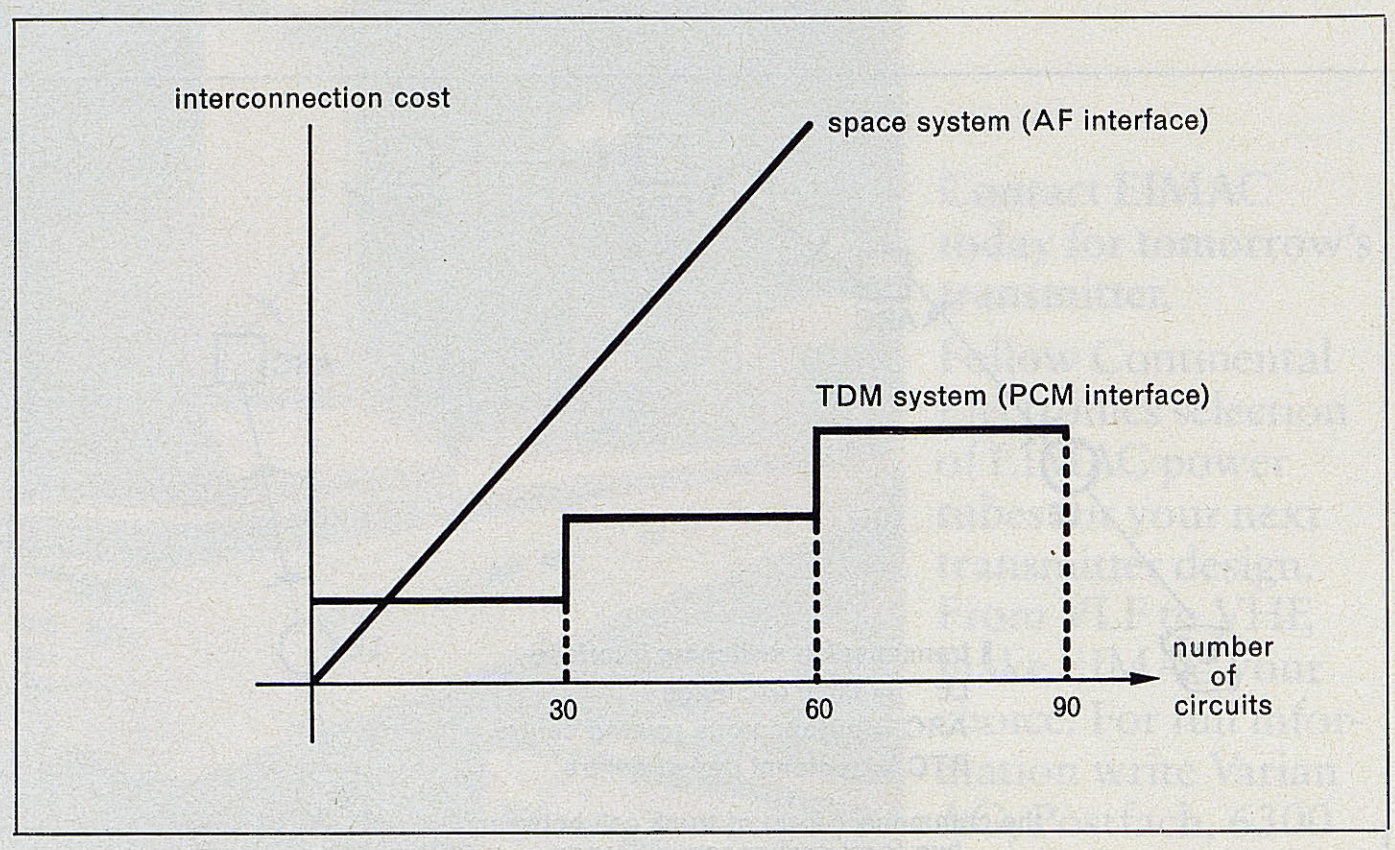


Figure 4

2.2 Operation of integrated networks

Turning now to "operations", it should be noted that the main spin-off from integration mentioned above is accompanied by by no means negligible side effects. Among the most important of these effects, we may point to the improvement of transmission quality resulting from the ability of digital transmission to provide a consistent standard irrespective of distance. Noise and attenuation will no longer be a problem. The result will be an additional saving on the distribution network, for which a higher attenuation can be tolerated, corresponding to a gain achieved on the integrated part of the network.

Maintenance will be much easier, with favourable effects on the network operating costs; this is due to:

- the introduction of new signalling systems tailored to the digital network and replacing multi-frequency systems by logic units,
- easy supervision inherent in the digital nature of the data transmitted and switched, immune to slight deviations of components and capable of being monitored permanently and accurately on the basis of the error rate,
- the systematic use of very reliable semiconductors and plug-in elements which are easy to supervise and to test during service.

Actual commissioning will be easier for the integrated than for the conventional network; the engineering rules are already considerably simplified for an automated switching centre alone, since its highly modular structure makes for easy dimensioning. Sharply reduced interconnection costs also facilitate the choice of network structure, because this choice is economically less critical.

The characteristics of the integrated telephone network may be summarized by pointing out that the bulk of the cost is accounted for by the subscriber line/digital interface and that the digital part, the cost of which is relatively independent of location, at least where a reasonable number of lines is involved, is situated very near the subscriber (which reduces the length of metallic lines).

Once they have been digitized, signals can be switched and transmitted at little cost; this allows for optimization which stresses operational flexibility (invulnerability to accidental overloading or that due to forecasting errors) and security (resistance to cut-offs or destruction); flexibility and security are additional benefits, since the network as a whole is made more economical by the drastic reduction in transit costs and the elimination of transmission terminals.

Although the foregoing comments on the advantages of switching-transmission integration relate to telephony, we are also witnessing rapid progress in communica-

tions of all kinds, data, facsimile, etc. transmitted on the telephone band, either on the switched network or on circuits or groups of circuits dedicated to this use. The same processes can and will be introduced on the integrated network and will benefit from the quality improvement and cost reduction which are special features of switched networks.

A radically new possibility is nevertheless offered by the immediate use of the 64 kbit/s rate employed for telephone signalling throughout the integrated network and which is routinely switched and transmitted through this network, hence, already available. This will considerably enhance the potential of the telephone channel for all non-speech signals, which will lead to order of magnitude changes in the cost of transmitting various data for all bit rates below 64 kbit/s.

When this switched bit rate is made directly available to the subscriber by means of a digital subscriber line applicable either to speech or to various data or signals (high-speed facsimile, still picture transmission), the way will be clear for a very wide expansion of these services.

The integrated network, originally designed mainly for telephony, is thus capable of handling a much wider range of services, to the extent that it may be able to perform all the functions of existing or future specialized networks. However, even if these networks remain independent, the existence of the integrated network will assist them considerably by the digital media that are put at their disposal anywhere throughout the country.

2.3 Implications for industry

We are bound to consider the industrial repercussions of the problems raised by the development of digital integrated networks. In the transition from electromechanical to time-division multiplex systems, the nature of the products supplied by the switching equipment manufacturers has changed radically. For example, crossbar equipment is made of simple components—plates, rods, metal wires—and involves a considerable amount of work in the plant. TDM switching equipment, on the other hand, consists of very elaborate components, which are not generally produced by the actual telecommunication equipment suppliers; they are, in fact, the components in general use in electronics—semiconductors, passive components or even mechanical components (for connections). Since these components are in current use in an industry much more extensive than telecommunications, they are produced on a very large scale and therefore at low cost. Telecommunication manufacturers are therefore obliged to use them, subject to certain precautions dictated by reliability and durability considerations, which are more stringent in telecommunications than in most other applications.

This use of very generalized components concerns in particular the logic functions in automatic switching centres. The giant strides made in the design of memories, microcomputers and the associated circuitry stimulate this use of increasingly elaborate functions created to meet very general purposes. Although specific components for telecommunications have emerged, the technology belongs to the much wider sphere of signal processing (coders, decoders, filters, etc.). Here again, the component manufacturers are best placed to command a wide enough adequate market to encourage creativity and innovation. Nevertheless, certain very specific functions give rise to specially-designed items, using either discrete or low-integration components (hybrid circuits) or customized LSI circuits. The relative extent to which these two solutions are resorted to will presumably change in the course of time.

This situation clearly leads to a considerable reduction in the value added by the telecommunication manufacturer. Where the performance of a given network function is concerned, this is due to the reduction in the amount of equipment required, owing to the simplification resulting from integration, the lower number of components to be assembled owing to the increasing capacity of LSI components, and the transfer manufacturing tasks, since components are generally produced by specialized firms.

Another effect is the evolution of costs in time. The share of components in the total cost, together with improvements in assembly and test methods, entails a continous decline—without any change in the equipment—or a reduction in stages, since the advent of new components permits the continuance of the downward cost trend by revamping the equipment.

In this stage of flux, the telecommunication manufacturer must display some virtuosity in order simultaneously to achieve competitive prices combined with reasonable product stability, while at the same time taking the utmost advantage of the expanding potential of technology to upgrade as far as possible the performance of the equipment from the standpoint of operating convenience—reliability, cost and ease of operation and maintenance, which, together with price reduction, are decisive considerations for the user.

2.4 Prospects for the development of integrated networks

We should now ask ourselves one last question: what will be the future pattern and rate of development of integrated networks in different countries?

The considerable benefits to be derived from the integration of switching and transmission gradually emerge in a network as the introduction of digital transmission and switching progresses. The existence of a large proportion of electromechanical automatic switching equipment and of analog transmission media in nearly all networks means that changes must be made gradually.

The problem differs according to the rate of network growth:

A. In developing countries with rapidly expanding telephone networks, digital switching and transmission systems may be expected to supersede analog systems very quickly in all new installations.

This will soon lead to the digitization of the entire network, making the elimination and gradual replacement of old systems more profitable. The impetus behind this replacement policy is the wish to find uniform solutions to operational and maintenance problems.

B. In countries already possessing a large infrastructure, the same factors may militate in favour of the replacement of old equipment, but the motive for renewal operations will be the general introduction of new services.

There is therefore reason to believe that in all cases the general advantages of TDM switching/transmission integration will mean speeding up programmes for the replacement of obsolescent equipment in the next few years, which will provide a stimulus to our industry.

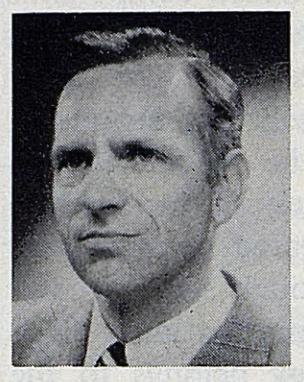
3. Conclusion

A genuine revolution is in progress in the design of telecommunication networks and in the type of equipment used. The fact that this revolution has not yet come to an end is evidenced by the wealth of research and development work now under way throughout the world on the digital processing and transmission of information. It will result in a much wider range of services offered to users combined with greatly reduced costs.

This revolution is the result of unprecedented technical and technological innovations—the aftermath of the great discoveries made in the early 20th century in the field of matter and solid physics.

(Original language: French)

The evolution of FDM carrier equipment, 1938-1978



by
F. J. HOFMAN
Central Transmission Branch PTT
and
A. VAN DEDEM
Philips' Telecommunicatie Industrie BV
Netherlands

Introduction

SINCE their initial acceptance in the 1930s as a means of increasing the usefulness of existing circuits, carrier multiplex systems have developed from clumsy, brute-force facilities into highly sophisticated systems employing some of the most advanced techniques in the electronics field. From the early days when a 12-channel system of open-wire carrier occupied four full bays, dissipated 500 W of power, and was regarded with considerable suspicion by maintenance personnel, carrier techniques have progressed to the point at which an operating 1200-channel system can be accommodated in the same space, with less total power consumption, and with a reliability which permits months of unattended operation.

The Netherlands PTT, since the commissioning of the first 12-channel system in 1937, has installed over 200 000 channels of FDM carrier, primarily on symmetrical cable and radio. This article is a brief review of some of the changes which have taken place in carrier equipment over the past four decades, and the impact of these changes on the economic, operational and administrative aspects of the Dutch telephone system.

Space occupancy

Forty years of continued improvement in component, circuit design and packaging techniques have, of course, had a profound influence on all the characteristics of carrier systems, but nowhere has this influence been more noticeable than in the area of space occupancy.

In early systems, good design implied generosity—in size, weight, and performance margins—because there was no

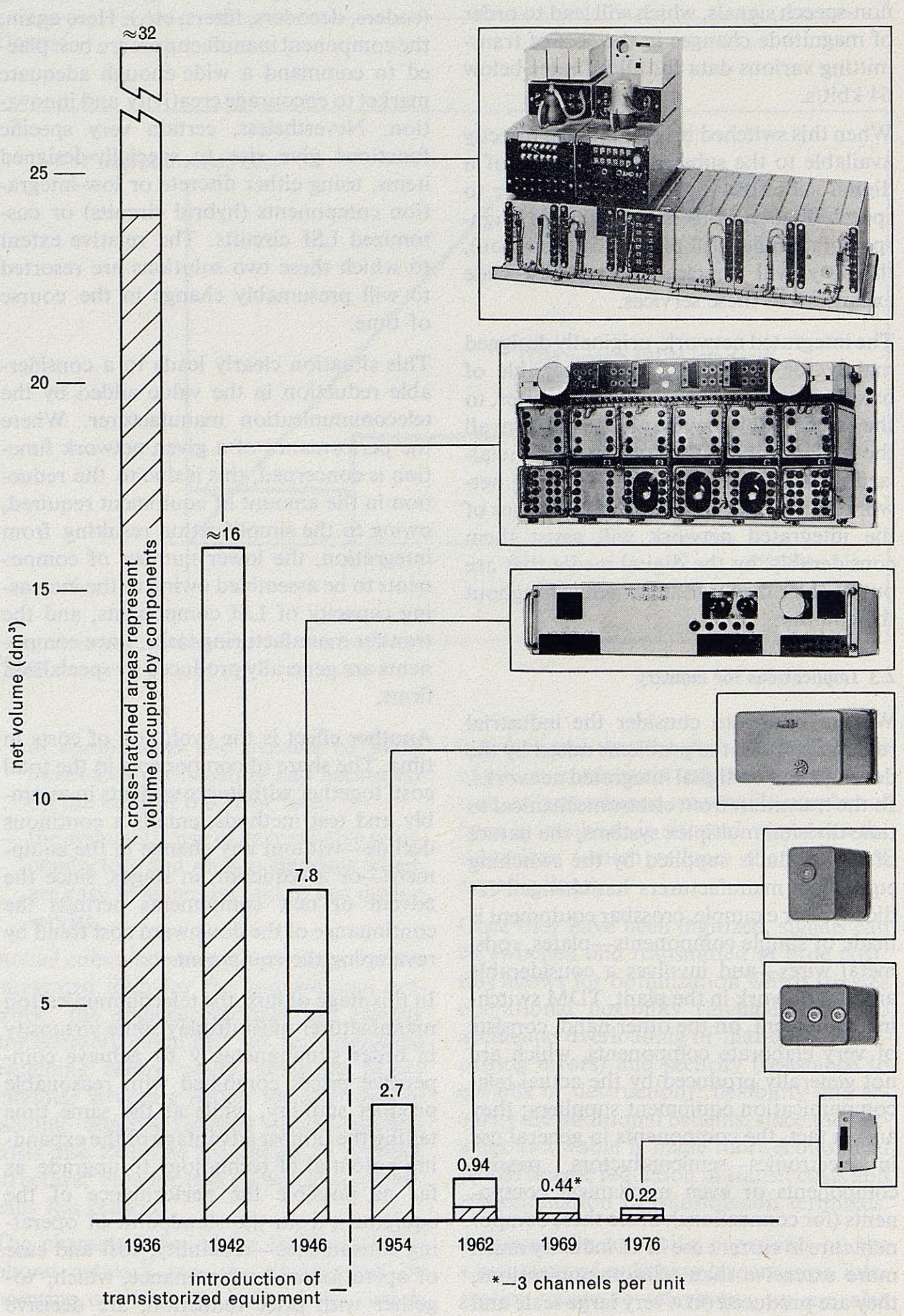


Figure 1—Channel modem size reductions, 1936-1976

compelling need for compactness. Since carrier-derived channels were relatively little used, uncertainty about component reliability could be offset by extensive derating and liberal heat dissipation arrangements. The explosive growth in demand for telephone service after World War II vastly increased the amount of equipment required, and created an urgent need for reduction of equipment size. A 60 MHz carrier system built to 1946 construction standards would have occupied roughly 1500 bays—an obviously impractical real estate requirement.

Figure 1 illustrates the size reductions achieved in seven generations of channel modems during the period from 1936 to 1976; the net volumes of these units are also shown, with an indication of the proportion of overall unit volume actually occupied by components in each case. Although the introduction of solid-state devices had a major effect on physical size, important advances in the design of filters and other components also contributed to the sharp decrease in occupied space, both for channel units and higher-order modulation equipment. At the present stage of development, after a reduction of approximately 150:1, the volume of a channel modem is governed more and more by considerations of physical access and handling rather than circuit design.

The impact of progressive miniaturization on channel modem bayframe occupancy is shown in figure 2; the 200:1 improvement since 1937 is higher than the actual reduction in channel unit volume because of comparable reductions in the space required by power supplies, carrier distribution equipment, alarm and measurement units, etc.

While the figures given in figure 2 are significant due to the relatively high proportion of overall system space occupied by channel modems, it is also important to consider the effect of miniaturization in carrier supply and higher-order modulation equipment. In 1962, when systems of such density first became feasible, a hypothetical terminal station equipped with four complete 2700-channel carrier systems occupied a total of 154 bays. The same station can now be housed in 31 bays, and the four 12 MHz systems can be combined to provide a 10 800-channel 60 MHz facility by adding a single additional bay.

Transmission performance

One of the most remarkable results of a review of carrier system performance characteristics since the 1930s is the realization that many of them have actually changed very little. The steady demand for wider system bandwidths and the influence of long international connections have, of course, imposed severe engineering requirements on equipment design to maintain the same per-channel standards as earlier systems, but a great many of the long-term needs were anticipated in international recommendations, and have not changed.

Among the characteristics which have altered are those associated with channel modem performance: passband frequency response; filtering in the stopband, which largely determines the degree of unintelligible crosstalk; and the filtering requirements imposed by out-of-band signalling.

Figure 3 is a compilation of various International Telegraph and Telephone Consultative Committee (CCITT) Recommendations and Netherlands PTT standards applied over the years. Curves 2 and 3 are for *circuits anciens*, and are included only as a historical comparison. The first carrier equipment installed in the Netherlands, a 12-channel, 8-56 kHz band double-modulation system developed between 1935 and 1937 in the PTT laboratories, followed the International Telephone Consultative Committee (CCIF—predecessor

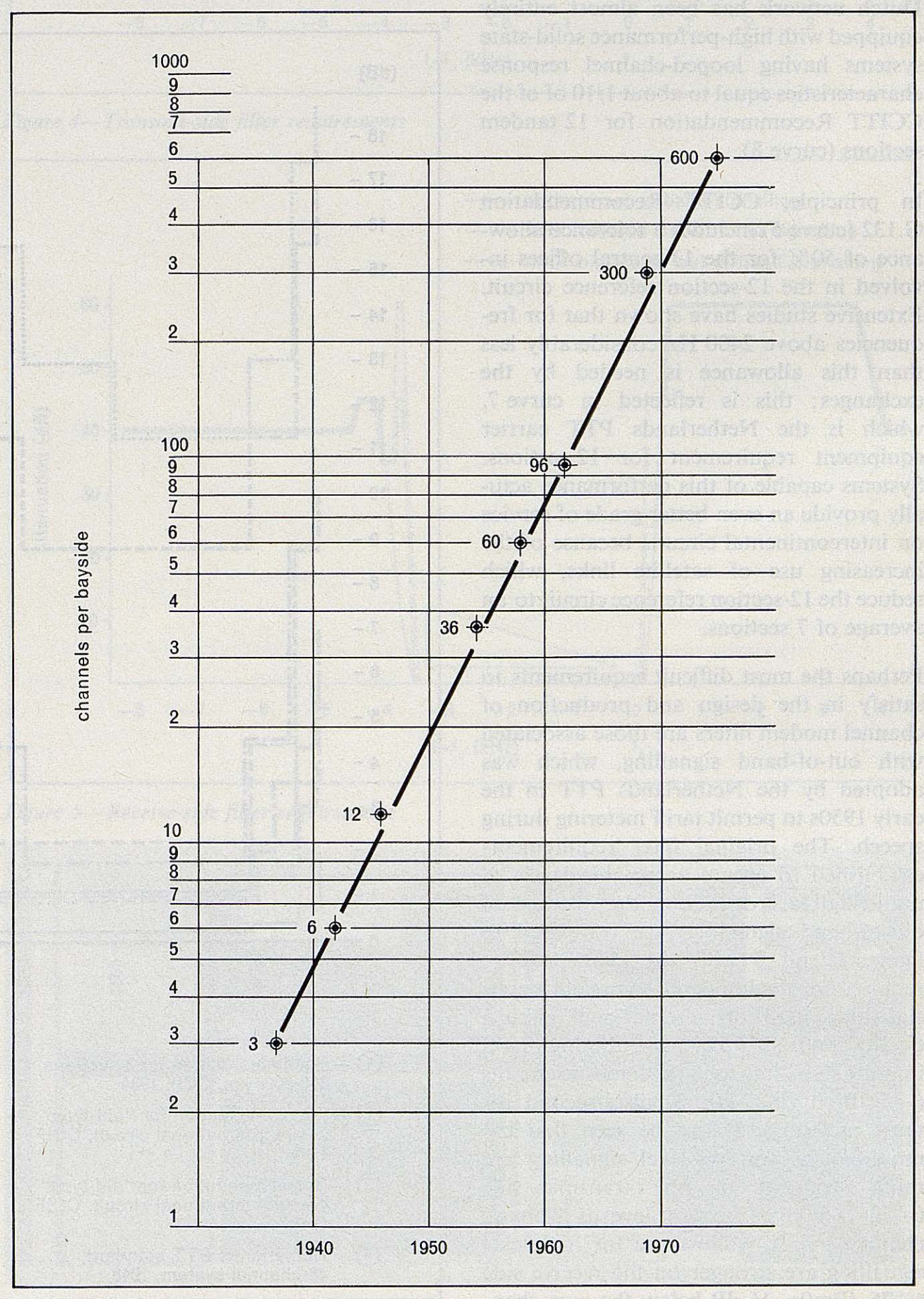


Figure 2—Channel modem bayframe occupancy

of CCITT) Recommendation of 1934 (Budapest), shown in curve 1. At this time there were no formal requirements for individual channel modem performance, but the PTT had established a 0.87 dB requirement at 600 and 2400 Hz, and 3.5 dB at 300 and 2700 Hz; the upper passband limit was extended to 3400 Hz as a result of the CCIF Paris meeting in 1937, with the same specifications.

In 1948, a new 48-channel carrier system was introduced, with more severe filter requirements (curve 4). It is interesting to note that these requirements were more stringent than those laid down for the first transistorized equipment in 1964 (curve 6), largely because the 48-channel system used in-band signalling. Since then, the Dutch network has been almost entirely equipped with high-performance solid-state systems having looped-channel response characteristics equal to about 1/10 of of the CCITT Recommendation for 12 tandem sections (curve 8).

In principle, CCITT Recommendation G.132 (curve 5) includes a tolerance allowance of 50% for the 13 central offices involved in the 12-section reference circuit. Extensive studies have shown that for frequencies above 2400 Hz considerably less than this allowance is needed by the exchanges; this is reflected in curve 7, which is the Netherlands PTT carrier equipment requirement for 12 sections. Systems capable of this performance actually provide an even better grade of service on intercontinental circuits because of the increasing use of satellite links, which reduce the 12-section reference circuit to an average of 7 sections.

Perhaps the most difficult requirements to satisfy in the design and production of channel modem filters are those associated with out-of-band signalling, which was adopted by the Netherlands PTT in the early 1950s to permit tariff metering during speech. The original filter requirements established to ensure acceptable levels of unintelligible crosstalk in the absence of out-of-band signalling, are compared in figures 4 and 5 with the characteristics required for the low-level, semi-continuous signalling used on international circuits (−20 dBm0, 3825 Hz), and the high-level impulse signalling used on domestic circuits (−5 dBm0, 3825 Hz, 3 pulses/second for tariff metering). It can be seen that the requirements for low-level signalling are more stringent on the transmit side (−73 dBm0p, or the same level as the basic channel noise), while those for high-level signalling are stronger on the receive side (−76 dBm0p, 16 dB below the own-channel interference level).

The economics involved in producing such high-quality filters are such that the Netherlands PTT now uses two types of channel modem, one for domestic service and one for international circuits. Aside from the difference in filter characteristics the units are virtually identical.

Channel capacity

The steady expansion of system capability from 12 to 10 800 channels over the period of this review is well documented and requires no further comment, except to say that the standardization activities of the CCITT have been of particular importance in this area. The present world-wide network of interconnectable carrier facilities would not have been possible without co-ordination of frequency allocations and modulation plans.

Reliability

Significant improvements were made in the reliability of tube-type equipment during the 1950s, due primarily to steady decreases in component failure rates and the use of a special equipment packaging technique, developed by *Philips' Telecommunicatie Industrie BV* in co-operation with the PTT. The "conclave" form of construction, shown in figure 6, provides a high degree of environmental protection for circuitry

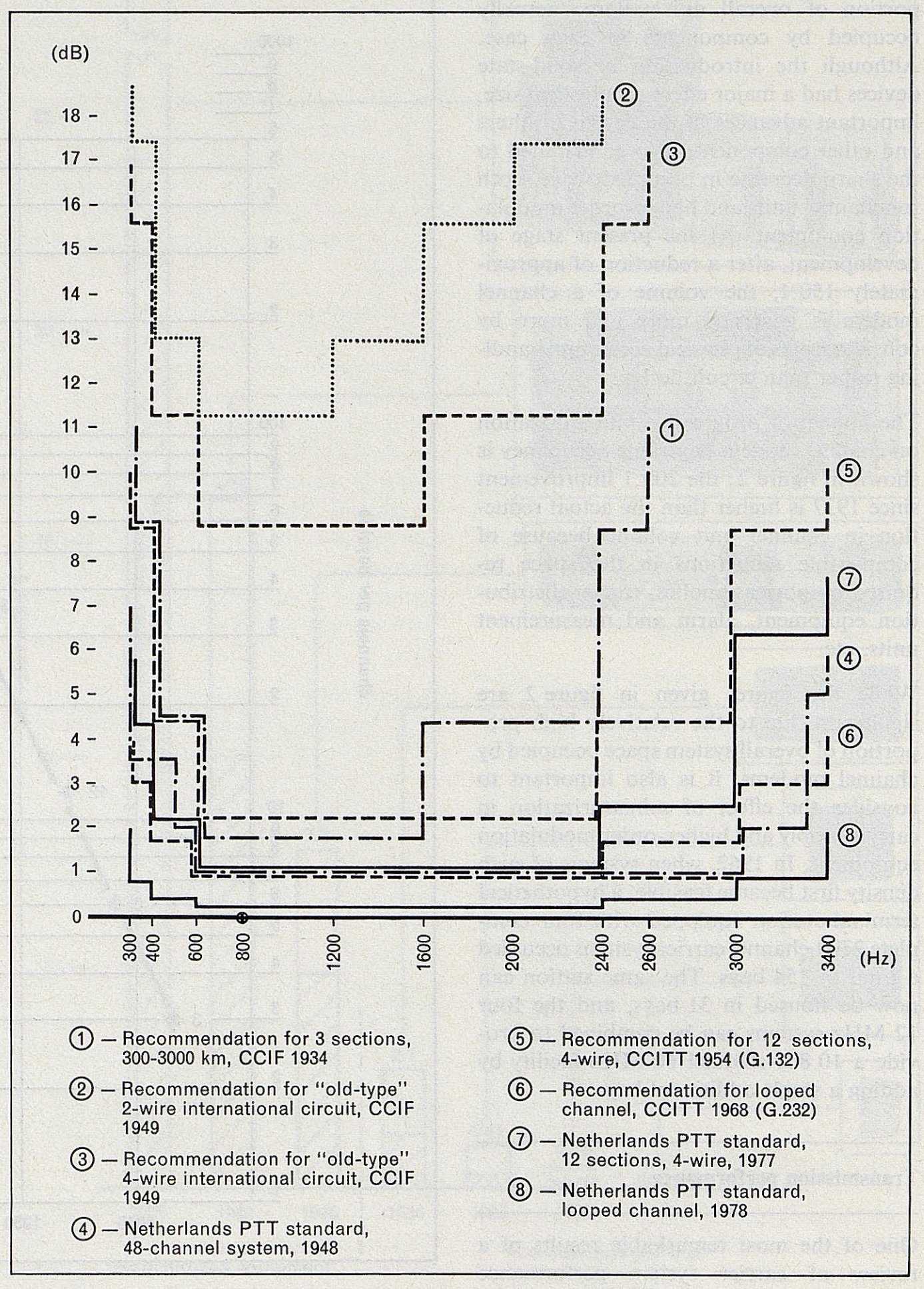


Figure 3—Comparison of channel response characteristics

without restricting access for servicing, and has made an important contribution to system reliability over the past 25 years. More recent component developments, including hermetically sealed solid-state devices and moulded polystyrene capacitors, have made such protection unnecessary, and open-card construction is now common.

The most dramatic advance in reliability unquestionably came with the introduction of solid-state equipment in 1963/1964. As happened in so many other areas of electronics, the transistor, and subsequently the integrated circuit, had far-reaching effects on mean time between failures (MTBF), and indeed on the whole philosophy of telecommunications equipment application and support.

Figure 7, a statistical overview of the growth of the Dutch carrier network from 1955 to 1978, demonstrates the impact of solid-state equipment on circuit availability and on maintenance staff requirements. Curve 1 shows the number of primary groups installed; each group comprises two 12-channel terminals of multiplex (or 8-channel terminals in the case of some 6 kHz equipment still in service), plus the line or radio equipment involved. As of 1978, there were approximately 297 000 channel modems in the network, of which 255 000, or roughly 86%, were solid state.

Curve 4 represents the total number of circuit interruptions experienced during each year; an interruption is defined as any occasion on which a channel or group falls below operating tolerances for any reason, including cable failures or radio propagation difficulties. The salient point illustrated by the curve is that the absolute number of interruptions has increased by less than 50% since 1955 despite an increase of over 2500% in the amount of installed equipment. Expressed in terms of faults per 100 operating circuits (curve 5), the number of interruptions has dropped by over 95%, from 38.7 in 1955 to 3.5 in 1978.

The proportion of circuit faults specifically attributable to carrier equipment, although not defined, is relatively low—perhaps 10% of the total. Calculations show that the vast majority of carrier equipment failures occur in the older tube-equipped systems; some 80% of the total failures are caused by 15% of the installed equipment, as indicated in the insert to figure 7.

Examination of the failure rates of the solid-state equipment in service, over a period of almost 15 years, yields a channel modem MTBF figure of more than 300 years, and complete point-to-point channel MTBFs of between 20 and 30 years for systems up to 12 MHz. With

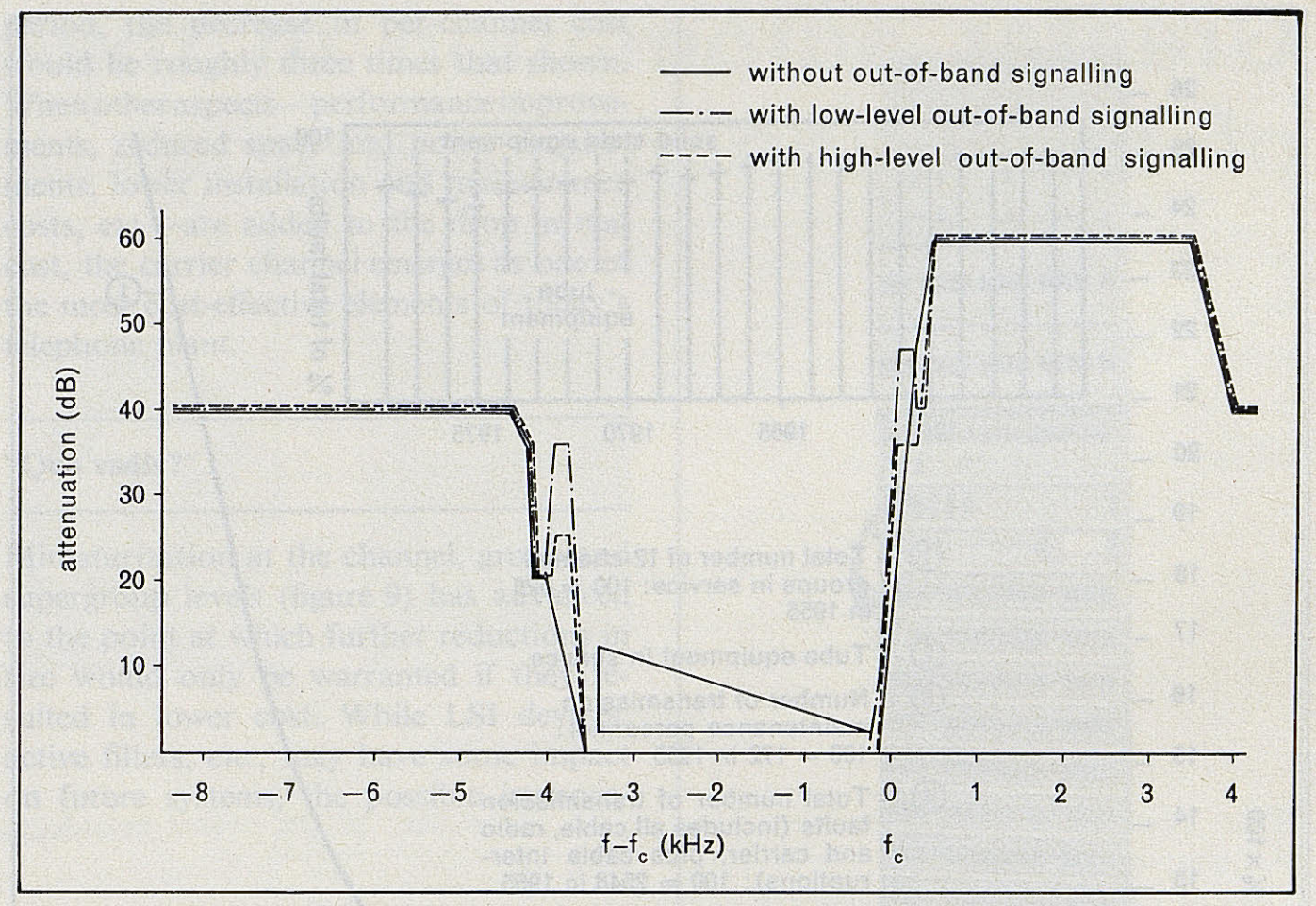


Figure 4—Transmit-side filter requirements

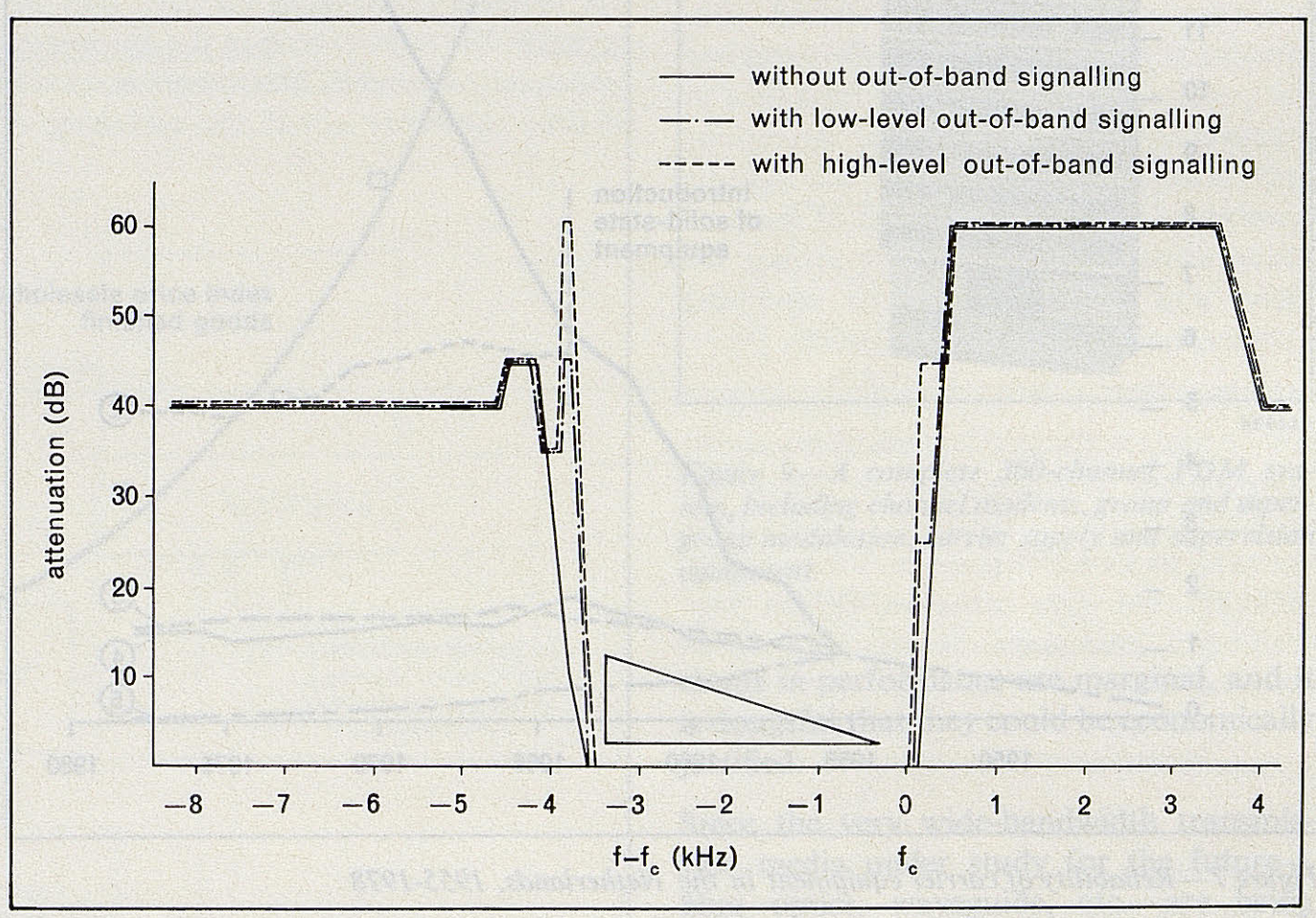


Figure 5—Receive-side filter requirements

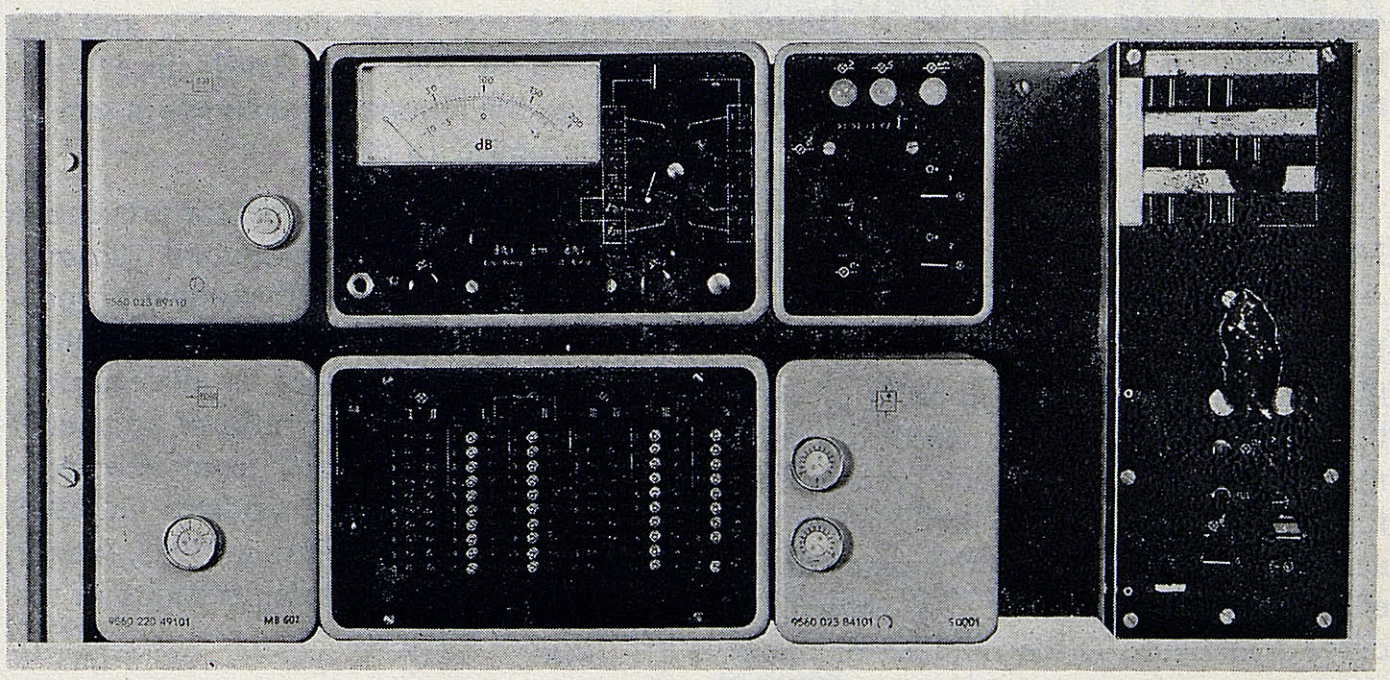


Figure 6—Physical arrangement of supervision equipment with fast scanning facilities

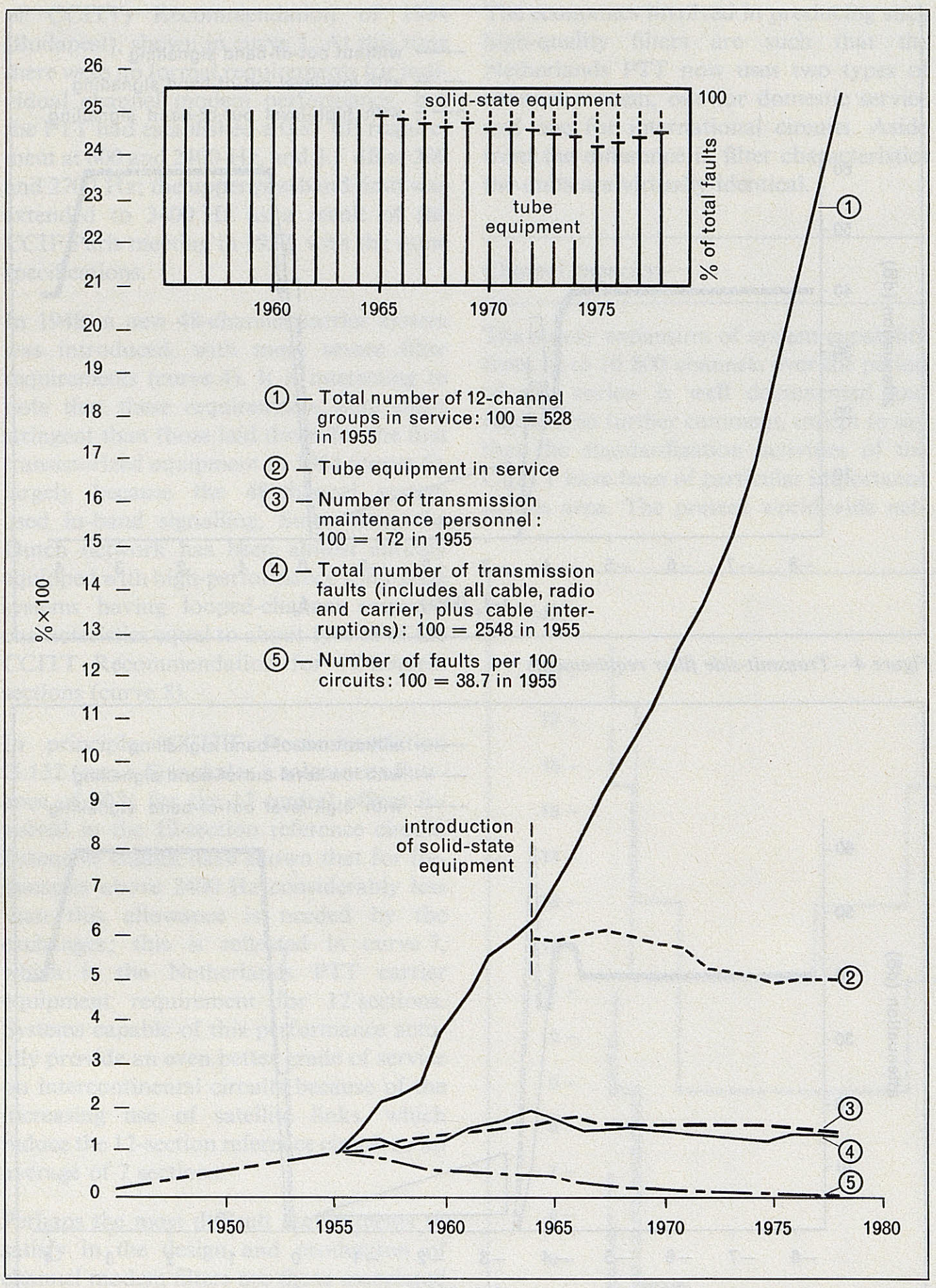


Figure 7—Reliability of carrier equipment in the Netherlands, 1955-1978

duplicated carrier supplies, the MTBF of a high-density system can equal or exceed the normal economic lifetime of the system.

Maintenance requirements

Reliability *per se* is obviously important from the subscriber service point of view, but an equally significant aspect of equipment development in recent years is that the required standards of performance are achieved with a fraction of the maintenance effort formerly required. As shown by curve 3 in figure 7, the number of maintenance personnel involved with transmission equipment in the Dutch network has increased very little since 1955, and has remained at the same level since 1963, although the number of channels in service has multiplied 18 times.

The field staff is responsible for preventive and corrective maintenance of all transmission systems, and a relatively low proportion of their time is spent on carrier equipment. Even if this fact is disregarded, figure 7 shows that the ratio of personnel to equipment has altered from one technician per 75-channel modems in 1955 to one per 1100 modems in 1978. Fewer than 1/10 of the multiplex stations in the network are attended.

The amount of corrective maintenance required has decreased sharply because of improved equipment reliability, as noted earlier, and the economics of corrective maintenance have also been significantly influenced by centralized maintenance techniques utilizing automatic alarm transmission from unattended stations. Fast scanners of the type shown in figure 6 are used to supervise mastergroup and supermastergroup pilots and provide remote alarms to a central location in each maintenance area. Preventive maintenance and routine adjustment have also been drastically reduced; the traditional requirements for regular checks of such parameters as tube anode and cathode current, periodic adjustment of oscillators, pilot generators, etc., have been largely eliminated.

Generally speaking, no preventive maintenance is carried out on contemporary carrier equipment, and the occasional checks which are performed can be done easily and quickly with the aid of the sophisticated test and measurement facilities now available.

Per-channel cost

A meaningful comparison of the manufacturing cost of a multiplex channel now and 40 years ago is virtually impossible to make. In the early days of the carrier art, basic development costs were very high and the quantity of units built was low, whereas each generation of contemporary equipment primarily represents circuit refinements and changes in packaging, and relatively large quantities are built. The narrow channel cross-sections used during the 1940s did not involve expensive high-order modulation equipment, but on the other hand the influence of such equipment on the cost of an individual channel has steadily decreased as bandwidths have widened.

In addition to the introduction of solid-state active components, two major cost-reducing developments have taken place in the last two decades. Perhaps the most important of these was the application of printed-circuit techniques, which sharply reduced the labour content of the equipment and improved production efficiency by permitting automatic component insertion automated testing, and other time-saving steps.

The other significant occurrence was the development of high-performance ferrite materials. Since filters account for a high proportion of the cost of multiplex equipment, the elimination of costly laminated-core coil construction was a major step forward. Current techniques produce coils with linear temperature coefficients which can be much more easily matched to their

companion capacitors than could their predecessors.

Figure 8 illustrates the change in channel modem cost since 1946; for comparison purposes the change in the general index for finished goods is also shown. As can be seen, the cost of a modem has remained relatively constant since about 1960, when the techniques mentioned above came into general use, and is approximately half that of a unit installed during the immediate post-war period. The influence of filter requirements can be seen in the relative cost of the 6 kHz equipment used in the network between 1955 and 1961.

It should be noted that the cost figures reflected in figure 8 are unweighted; if they were adjusted to reflect the change in purchasing power of the guilder during the period, the decrease in per-channel cost would be roughly three times that shown. When other aspects—performance improvements, reduced space and power requirements, lower installation and maintenance costs, etc.—are added to the drop in real cost, the carrier channel emerges as one of the most cost-effective elements of today's telephone plant.

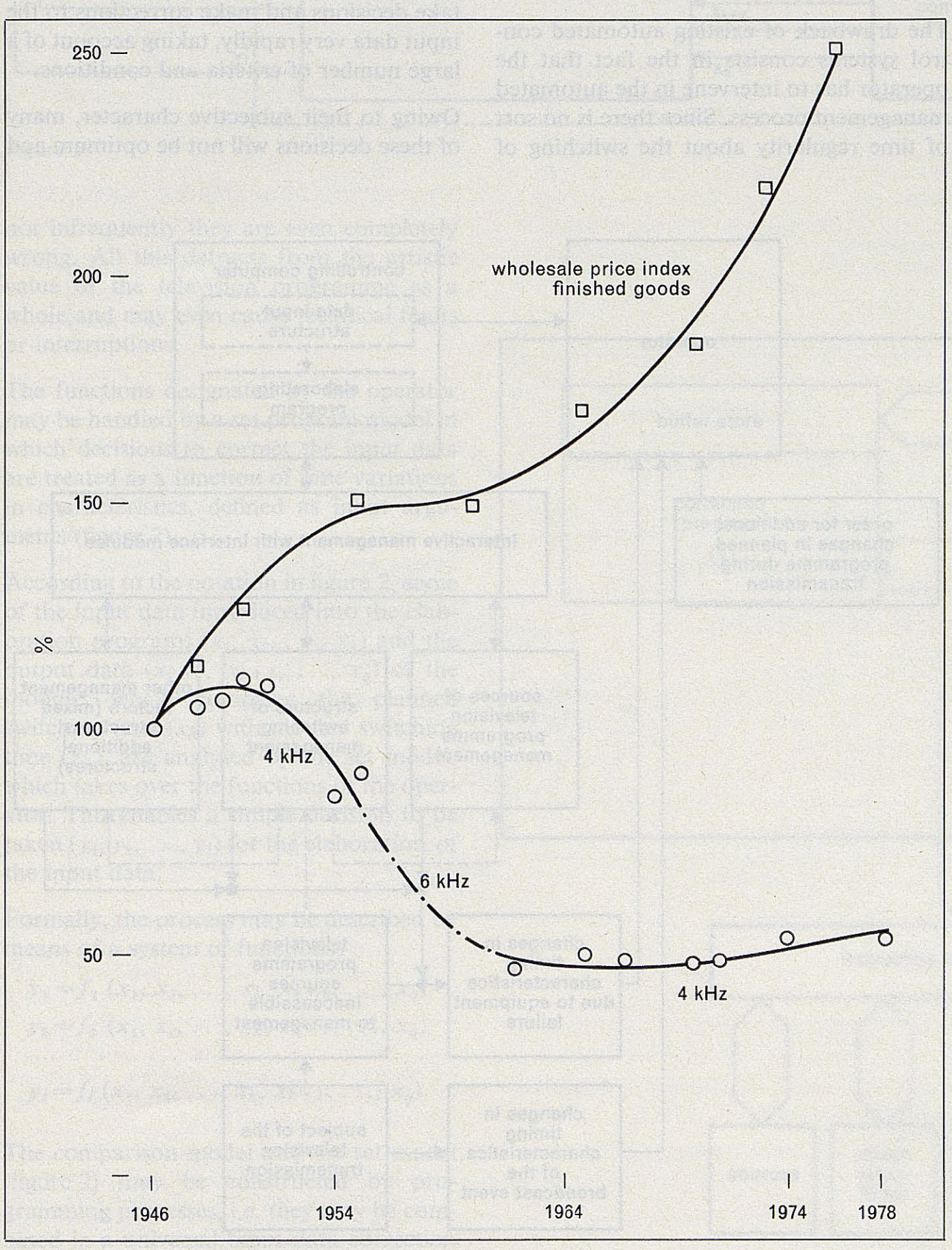


Figure 8—Channel modem cost changes, 1946-1978

"Quo vadis?"

Miniaturization at the channel, group and supergroup levels (figure 9) has advanced to the point at which further reductions in size would only be warranted if they resulted in lower cost. While LSI devices, active filters, etc., may have some impact on future systems, the possible improvements in performance are marginal, and it is doubtful that they could be economically justified.

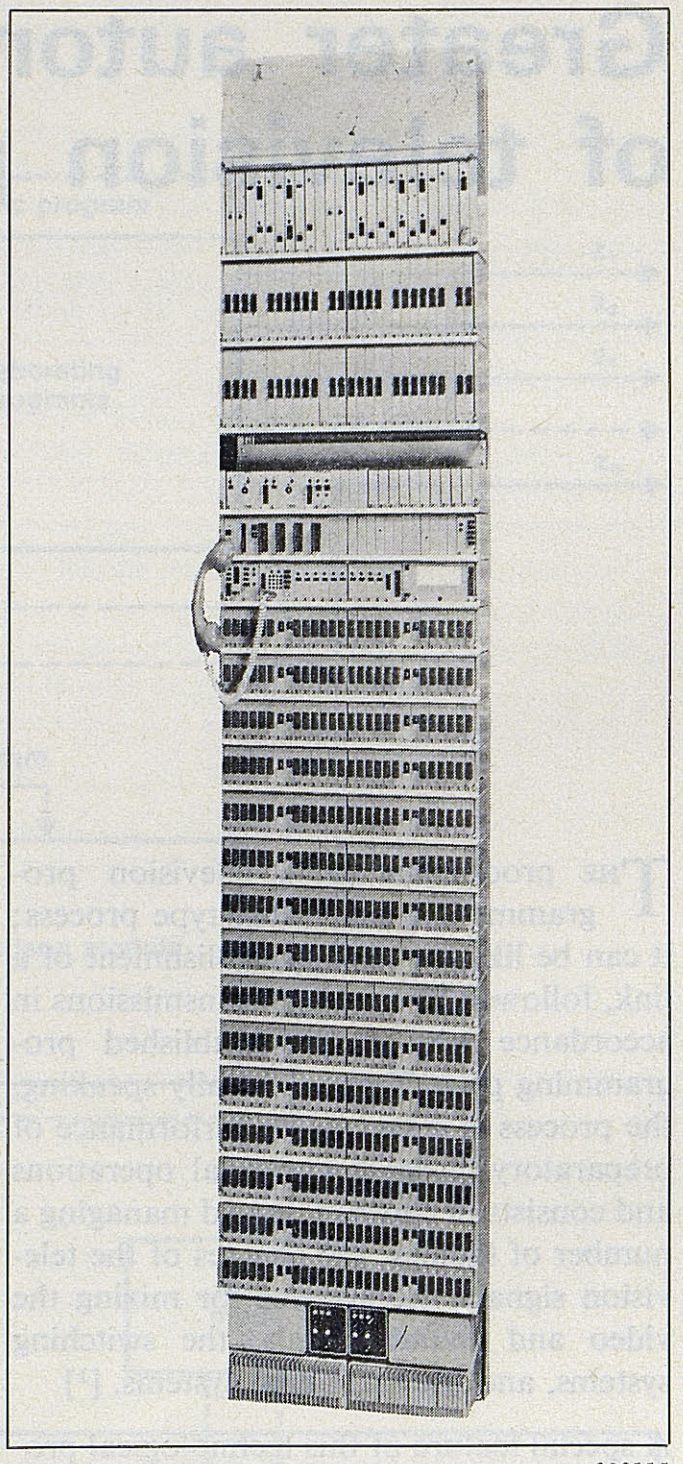


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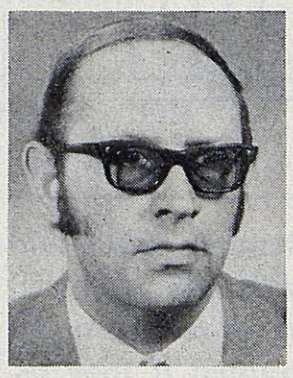
Figure 9—A complete 360-channel FDM system, including channel modems, group and supergroup modulation, carrier supply and supervision equipment

Since the very wide-bandwidth transmission media under study for the future—fibre optics, waveguide, etc.—are being considered almost exclusively in terms of digital techniques, there will probably be no FDM carrier development beyond the present 60 MHz systems, except perhaps for video transmission. In the Netherlands, PCM systems have to date only been employed between Class 5 and Class 4 offices, but field trials of 34 Mbit/s digital transmission on coaxial cable are planned for higher levels in the network. Future trends in the development of analogue equipment are difficult to predict in view of this increasing influence of digital technology, but there is no doubt that FDM carrier will continue to play an important part in telephone transmission, particularly in long-distance applications, for some years to come.

(Original language: English)

Greater automation in the production of television programmes



by
Anguel DELISKI
and
Bojidar GUEORGUIEV
Bulgarian Television Office (Sofia)

The production of a television programme is a caterpillar-type process; it can be likened to the establishment of a link, followed by separate transmissions in accordance with a pre-established programming plan. Technologically speaking, the process is a successive performance of preparatory, current and final operations and consists in controlling and managing a number of factors: the sources of the television signals, the systems for mixing the video and sound signals, the switching systems, and the additional systems. [1]

A special feature of this technological process is that, in the production of television programmes, changes occur in the timing of certain broadcasts which conflict with the need to fix starting times. To meet this difficulty, the data contained in the programming plan must be constantly corrected. This is one of the basic reasons why care must be exercised when seeking to automate the entire process.

As in the software of the existing automation systems, the technological process is handled by means of "routines"; television programmes cannot be produced without an "operator-computer" dialogue. During the televised programme, the operator keeps track of the changes in the timing characteristics of the broadcasts; he takes decisions and uses the "terminals" to elaborate and correct the input data during the transmission of the programme (figure 1). In principle, unplanned changes of data may be due to three causes:

a) variations in the timing characteristics of the events broadcast "live";

b) failure of the television equipment;

c) exceptionally important changes in the programme.

In practice, the main regular source of unplanned changes is the variation in the time parameters of the events broadcast "live".

The drawback of existing automated control systems consists in the fact that the operator has to intervene in the automated management process. Since there is no sort of time regularity about the switching of isolated transmissions, the operator who follows a television programme has often to take decisions and make corrections to the input data very rapidly, taking account of a large number of criteria and conditions.

Owing to their subjective character, many of these decisions will not be optimum and

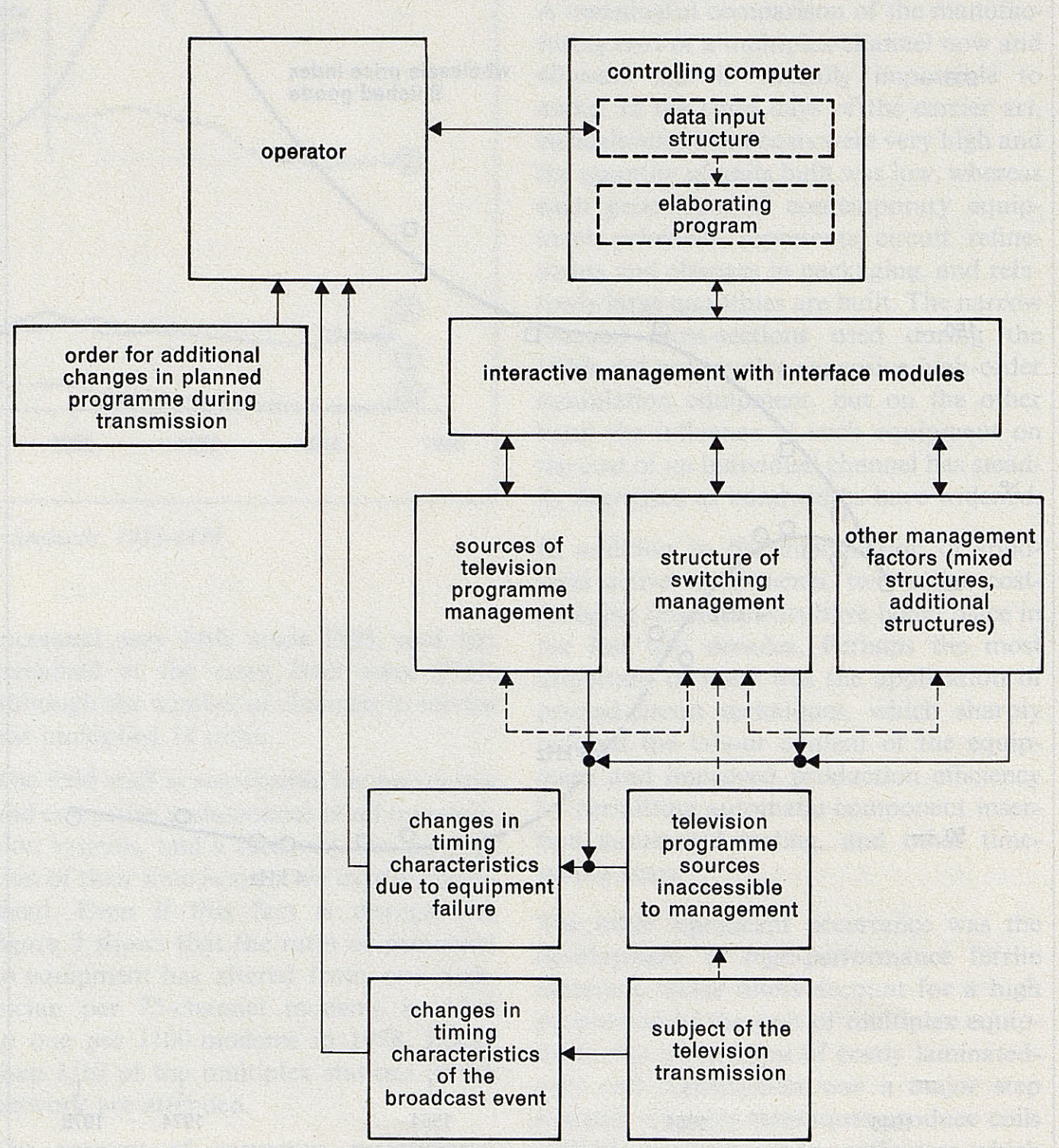


Figure 1

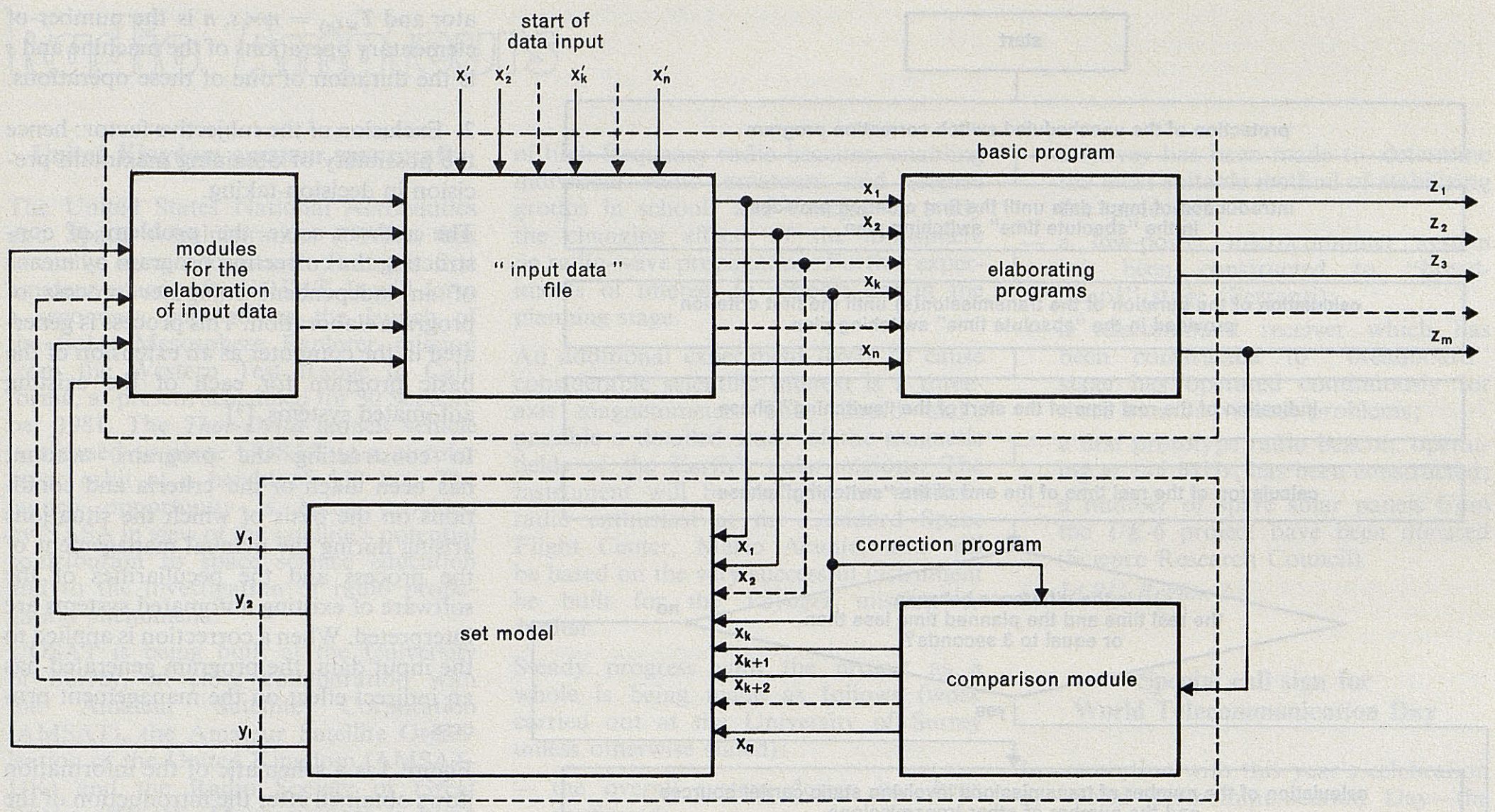


Figure 2

not infrequently they are even completely wrong. All this detracts from the artistic value of the television programme as a whole and may even cause technical faults or interruptions.

The functions designated by the operator may be handled by a set program model in which decisions to correct the input data are treated as a function of time variations in characteristics, defined as input arguments (figure 2).

According to the notation in figure 2, some of the input data introduced into the elaboration programs ($x_1, x_2, \ldots, x_k$) and the output data ($x_{k+1}, x_{k+2}, \ldots, x_q$) of the module, which compares the planned switching time (x_k) with the real switching time (z_m), are analysed by the set model, which takes over the functions of the operator. This enables a simple decision to be taken ($y_1, y_2, \ldots, y_l$) for the elaboration of the input data.

Formally, the process may be described by means of a system of functions:

$$y_1 = f_1\ (x_1, x_2, \ldots, x_k, x_{k+1}, \ldots, x_q)$$
$$y_2 = f_2\ (x_1, x_2, \ldots, x_k, x_{k+1}, \ldots, x_q)$$
$$\ldots\ldots\ldots\ldots\ldots\ldots$$
$$y_l = f_l\ (x_1, x_2, \ldots, x_k, x_{k+1}, \ldots, x_q).$$

The comparison model and the set model (figure 2) may be constructed by programming processes, i.e. they may be combined in a universal input data correction program.

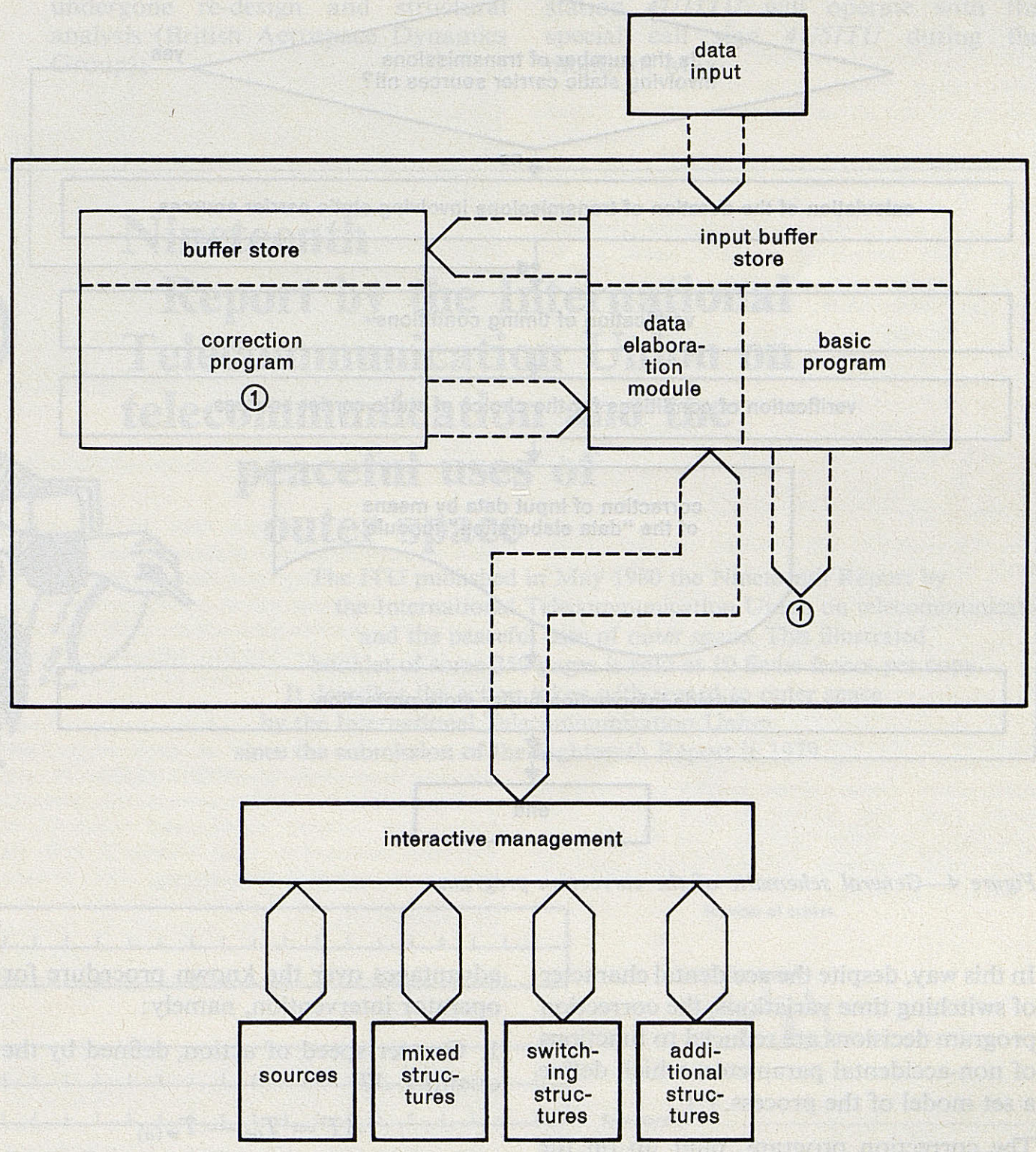


Figure 3—Data flow diagram after the introduction of the correction program

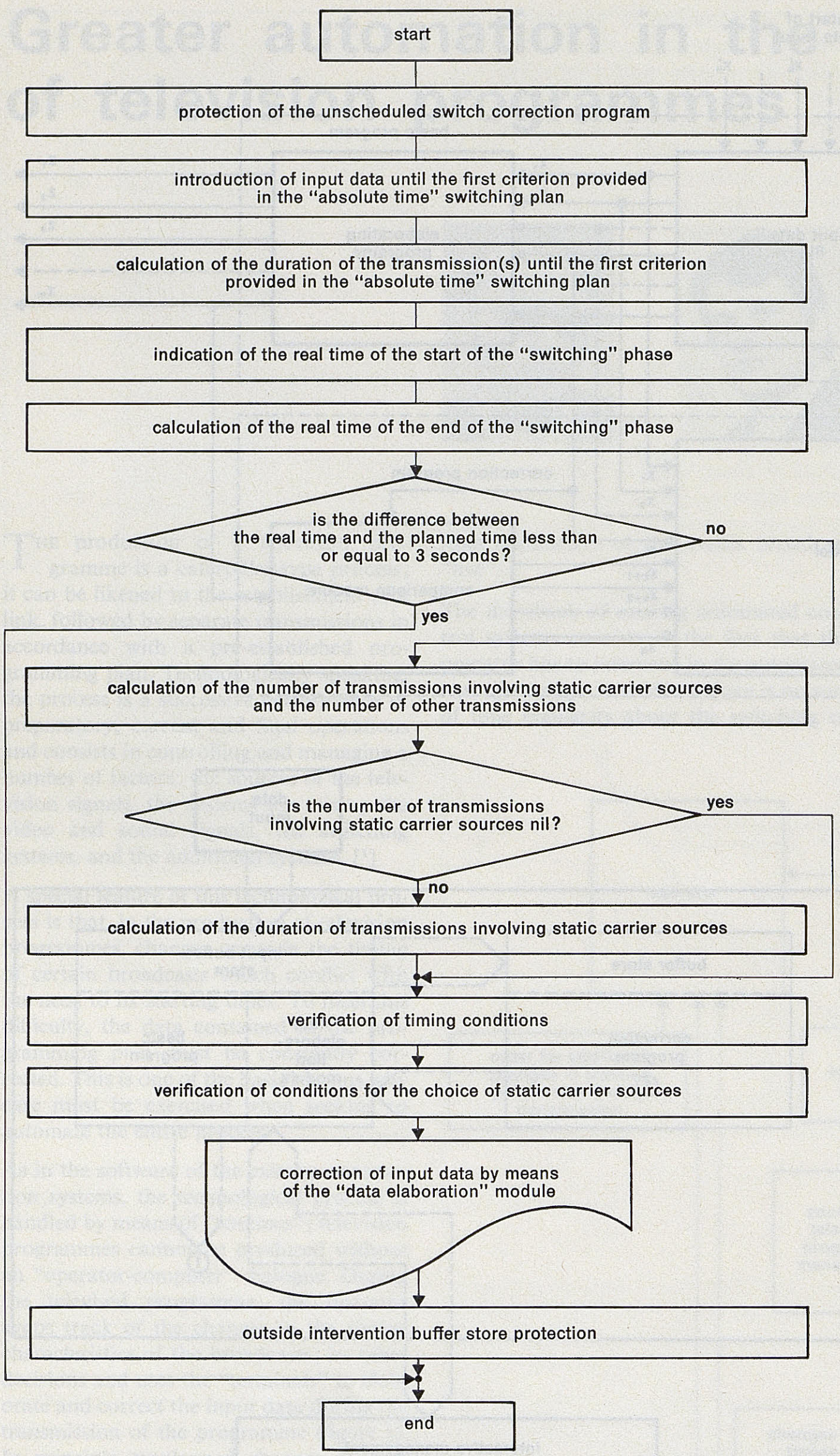


Figure 4—General schematic of the correction program

In this way, despite the accidental character of switching time variations, the correction program decisions are reduced to functions of non-accidental parameters which define a set model of the process. [2]

The correction program, built up on the basis of the set model, offers considerable advantages over the known procedure for operator intervention, namely:

1. Greater speed of action, defined by the quantity ΔT

$$\Delta T = T_{or} - T_{w(n)}$$

where T_{or} is the reaction time of the operator and $T_{w(n)} = n \times s$, n is the number of elementary operations of the machine and s is the duration of one of these operations.

2. Exclusion of the subjective factor: hence the possibility of obtaining maximum precision in decision-taking.

The authors solve the problem of constructing the correction program by means of an independent computer process of program elaboration. This process is generated in the computer as an extension of the basic program for each of the existing automated systems. [3]

In constructing the program, account has been taken of the criteria and conditions on the basis of which the situations arising during the manual management of the process and the peculiarities of the software of existing automated systems are interpreted. When a correction is applied to the input data, the program generated has an indirect effect on the management process.

Figure 3 is a schematic of the information flows obtained after the introduction of the program.

The most general schematic of its algorithm is given in figure 4.

The program is written in PL/1 algorithmic language and has been tested on IBM 360/40 and IBM 370/145 computers.

Conclusion

The correction program thus developed is unique of its kind. It is universal in character and easily adapted to all the existing automated systems used for managing the production of television programmes. It requires a minimum memory capacity of about 4 K.

The preparation and introduction of such a program forms part of the drive towards fuller automation of television programme production.

(Original language: French)

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Radio Amateurs

United Kingdom amateur spacecraft

The United States National Aeronautics and Space Administration (NASA) has formally agreed to launch Britain's first amateur spacecraft, *UOSAT*. It will form a secondary payload on the launch of the Solar Mesosphere Explorer mission from the Western Test Range in California, at present scheduled for 30 September 1981. The *Thor-Delta* launch vehicle is planned to place UOSAT in a circular polar orbit at a height of 530 km. The launch opportunity is being provided by NASA in view of the satellite's potential contribution to space science education and to the investigation of radio propagation phenomena.

UOSAT is being built at the University of Surrey, in close collaboration with the Amateur Satellite Corporation (AMSAT), the Amateur Satellite Organization of the United Kingdom (AMSAT-UK) and the Radio Society of Great Britain (RSGB). Much support is being given by Britain's electronics, telecommunications and space industries.

The purpose of the spacecraft is primarily educational. It will carry a series of high frequency radio beacons, enabling individual radio amateurs and science groups in schools and colleges to study the changing effects of the ionosphere on radio-wave propagation. Further experiments of interest to schools are in the planning stage.

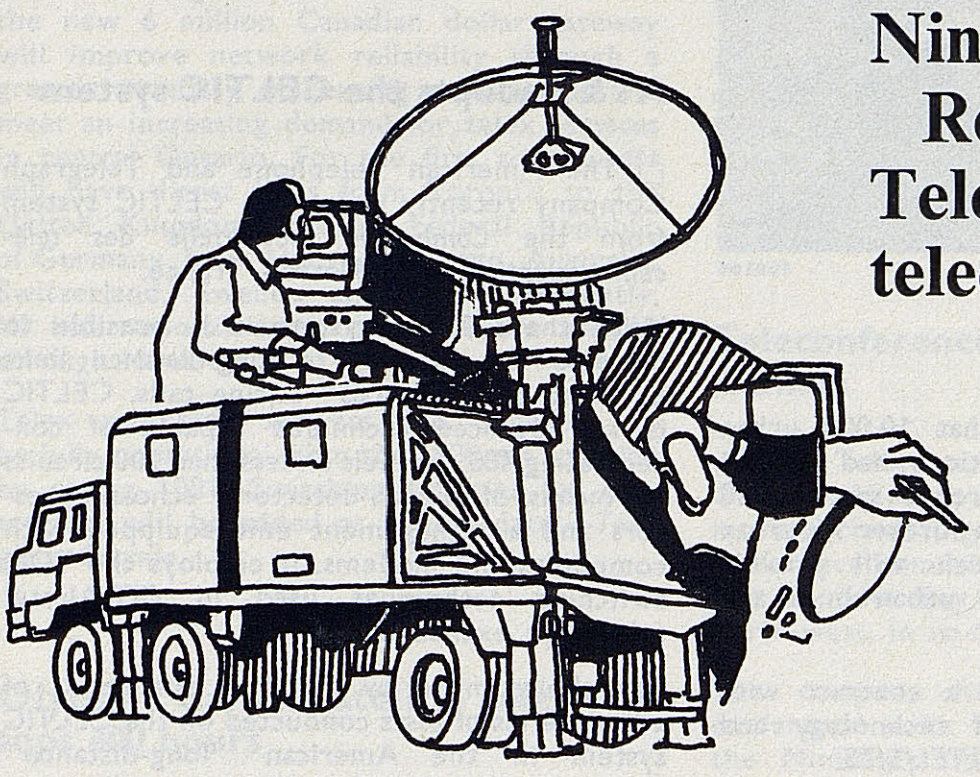
An additional experiment likely to cause considerable scientific interest is a three-axis magnetometer. This should make possible a detailed study of the magnetic fields of the Earth's polar regions. The instrument will be built by an amateur radio enthusiast at the Goddard Space Flight Center, Mario Acunia, and will be based on the very successful instrument he built for the *Voyager* mission to Jupiter.

Steady progress with the project as a whole is being made as follows (work carried out at the University of Surrey unless otherwise stated):

- — the overall system design has been confirmed;
- — the structure of the spacecraft has undergone re-design and structural analysis (British Aerospace Dynamics Group);
- — a survey has been made to determine the most suitable method of stabilizing the spacecraft;
- — a low-power microcomputer system has been constructed to "breadboard" stage (Ferranti);
- — a telecommand receiver which has been constructed to "breadboard" stage has operated continuously for three months without problems;
- — a first prototype radio beacon, operating at 145 MHz, has been constructed;
- — a number of spare solar panels from the *UK-6* project have been donated (Science Research Council).
- — *IARU Region 1.*

Special call sign for World Telecommunication Day

In connection with this year's celebration of World Telecommunication Day—the 115th anniversary of the founding of the Union at Paris on 17 May 1865—amateur station *4U1ITU* will operate with the special call sign *4U5ITU* during the month of May.



Nineteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space

The ITU published in May 1980 the Nineteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space. This illustrated booklet of some 250 pages is sold at 10 Swiss francs per copy. It describes the action taken with regard to outer space by the International Telecommunication Union since the submission of the Eighteenth Report in 1979.

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International Telecommunication Union, CH-1211 Genève (Switzerland)

News

Ireland goes digital

☐ The Irish Posts and Telegraphs Administration has decided to adopt the *Compagnie industrielle des télécommunications* (CIT-Alcatel) electronic *E 10* digital switching system.

The E 10 system has been chosen for all the applications in the Irish network in subscriber exchanges as well as in transit centres.

After an initial order of 100 million French francs to CIT-Alcatel and the associate Irish Company Telectron Ltd., the contracts will soon reach 400 million francs. The first exchange ordered for the Irish network will be cutover within a year. The overall investment programme of the Irish P&T amounts to 600 million Irish pounds (5.3 milliard francs) over a period of six years. The E 10 system will account for a significant part of these investments.—*CIT-Alcatel.*

New telephone exchanges

☐ Three countries which already use the *E 10* TDM switching system have placed further orders for the same system. They are the Yemen A.R., Syria and Mauritius.

Besides Damascus, which already has E 10 exchanges, Syria is to equip a further four towns with this system. The *Syrcotel* company, which manufactures the E 10 system under licence, has just received an order for 28 000 lines, certain units of which are to be produced in its Damascus factory.

The Yemen A.R. has decided to add 57 000 TDM lines to the telecommunication network now being installed, thus raising to more than 83 000 the number of E 10 lines contracted for in that country.

Lastly, the capacity of the existing TDM network in Mauritius is to be expanded, particularly in the capital, Port-Louis.

Altogether, these three orders are worth more than 200 million French francs and will raise to over 500 000 the number of E 10 lines installed or on order outside France.—*CIT-Alcatel.*

Minimum charge in public telephones cancelled in Austria

☐ As part of its campaign to improve customer service the Austrian Administration has abandoned, as from 1 February 1980, the minimum charge of 1 schilling hitherto made even for unsuccessful call attempts from a public call-box.

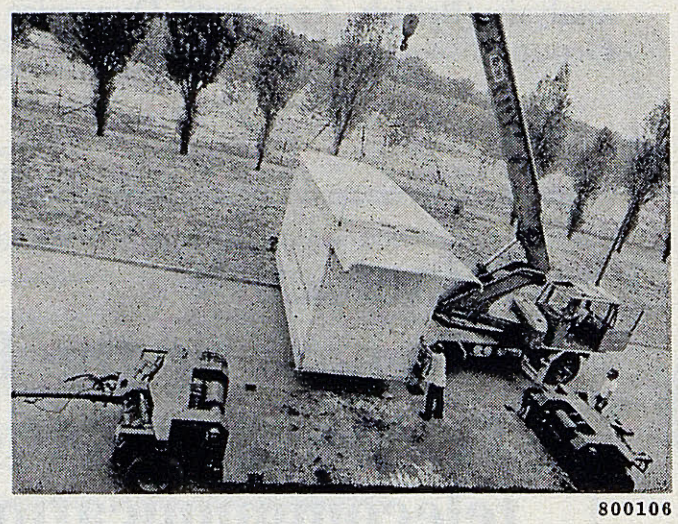
In future, customers will pay only for the number of call charge units actually counted.—*Austrian Administration.*

Direct telecommunications service between Cameroon and the United States

☐ Direct overseas telecommunications service between Cameroon in western Africa and the United States has been established by RCA Global Communications, Inc. The direct operation via an *Intelsat-IV* Atlantic satellite provides for telex and leased channel services.—*RCA.*

Proteo's progress

☐ At a recent press conference held in Milan in the presence of Senator Vittorino Colombo, Italian Minister of Posts and Telecommunications, the *Società Italiana Telecomunicazioni* (ITALTEL) and the *Società Italiana Telecomunicazioni Siemens SpA* (SITS) presented their programme for the manufacture of the *Proteo* electronic switching system.



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Proteo exchange in container

The companies revealed that 10 000 urban lines and 8000 trunk junctions had already been installed using the Proteo system and production had started on a further 76 urban and trunk exchanges which will provide by 1982 a further 110 000 urban lines and 33 000 trunks.

The firms also announced a contract with Brazil for the transfer of technology and systems "know-how".—*ITALTEL/SITS.*

News from the Deutsche Bundespost...

... in 1985 90% of all households will have telephones

☐ The *Deutsche Bundespost* expects that, by 1985, some 90% of all homes in the Federal Republic of Germany will have a telephone. At present, about 70% of private households have a telephone, whereas in 1960 the figure was only 15%.

... automatic dialling in 99% of foreign calls

☐ Nearly 99% of all international calls can now be dialled direct by Bundespost subscribers. In Europe, 99.4% of all correspondents can be reached by direct dialling. A few weeks ago subscribers in Argentina, Libya, Cyprus, Haiti and the Bahamas also became available by direct dialling. Thus the number of countries with which traffic has been fully automated has risen to 61 (27 in Europe and 34 elsewhere).—*Deutsche Bundespost.*

National automatic car radiotelephone network in France

☐ The General Telecommunications Directorate has engaged *Thomson-CSF* to study and construct a new automatic car radiotelephone system which will enable coverage to be extended throughout France.

So far, the automatic radiotelephone service has been open only in the Paris area and in the main regional cities. The areas covered are still geographically limited and the total capacity amounts to less than 10 000 subscribers.

In its final phase, the new system will offer users round-the-clock national coverage which will enable them to make or receive automatically local, trunk and international calls in their cars, wherever they happen to be in France. They will also enjoy all the new services of the telephone network.

It is expected that more than 100 000 subscribers in France will have this service by the end of the next decade.—*Thomson-CSF.*

AT&T adopts the CELTIC system

☐ The American Telephone and Telegraph Company recently ordered a CELTIC system from the *Compagnie industrielle des télécommunications* (CIT-Alcatel), France.

With the CELTIC system it is possible to increase the capacity of long-distance links by using the "silences" during calls. CELTIC is an advanced technique capable of concentrating 480 channels on less than 200 circuits by means of speech-detectors, echo-suppressors and a management unit equipped with computers and modems. It employs the TDM switching techniques used in CIT-Alcatel telephone exchanges.

The choice made by AT&T is the result of a long series of tests conducted on the CELTIC system in the American "long-distance" network. The initial equipment will come into operation in spring 1980 on a submarine link between Florida and the Virgin Islands.—*CIT-Alcatel.*

Viewdata terminals supplied to publisher

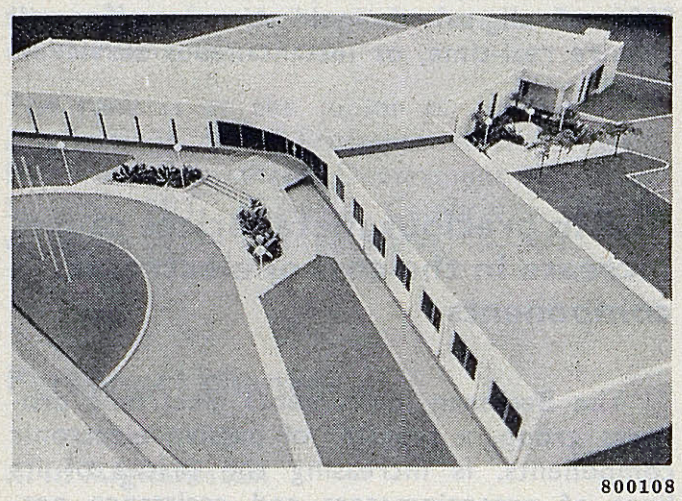
☐ Fifty special-purpose viewdata terminals were recently supplied by *Philips' Telecommunicatie Industrie BV* to TVS (Applied Viewdata Systems), a part of the publishing house *Intermediaire* of Amsterdam.

The terminals supplied to TVS are the VISA —a purpose-designed business terminal developed and manufactured by Pye TMC (a member of the Philips' group)—which are completely self-contained units with a built-in modem and an integral keypad to permit abbreviated dialling for calling the computer.

Philips has also supplied 60 of these terminals to the Netherlands PTT for their experimental closed-circuit viewdata system.—*Philips.*

Canada's second international telex gateway

☐ Plans for the construction of an international telex switching and data services facility in the Toronto suburb of Scarborough have been announced by Teleglobe Canada.



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A scale model of Canada's second international telex gateway to be located in Scarborough

Supplementing a first telex centre in Montreal the new 6 million Canadian dollar gateway will improve network reliability through a greater diversity of routing possibilities and meet an increasing demand for telex services in central Ontario. For the first time, users will have direct links from Toronto to the United Kingdom, France, Federal Republic of Germany, Italy, Hongkong, Japan, Australia, Switzerland, Sweden and Brazil. Presently, all international telex messages are routed through Montreal.

Telex switching services are expected to be fully operational from the 1900 m² complex by spring 1981. Switching facilities for data services will be added at a later date.—*Teleglobe Canada.*

Olympic Games satellite television tops 400 hours

☐ A tally of usage after the close of the Winter Olympic Games at Lake Placid showed that a total of 448 hours of international satellite television had been used.

Countries receiving Games telecasts directly included Australia, France, the Federal Republic of Germany, Japan, Mexico, the United Kingdom, Venezuela and Yugoslavia.

However, many of the telecasts were relayed from these receiving points to a large number of other countries via terrestrial networks.—*International Telecommunications Satellite Organization.*

Argentina's first optical cable link

☐ Argentina's first optical transmission link, which employs a *Siemens AG*-installed digital transmission system using optical cables, has been opened by the *Empresa Nacional de Telecomunicaciones* (ENTEL), the State telecommunications authority. The 3.7 km cable connects the local exchanges of Androgué and Burzaco in Buenos Aires. Apart from the practical application, ENTEL also plans to use this optical cable system to gather experience for similar projects in the future.

The cable, which is 7 mm in diameter, has been laid in existing cable ducts. It contains two 0.13 mm diameter graded-index fibres of fused silica lying loosely in plastic tubes approximately 1 mm in diameter. These fibres are stranded with two steel wires for anti-kink protection and also with strain relief members made of plastic yarn. The outer jacket is of plastic. The complete link has an attenuation of less than 20 dB and is made up of four lengths joined inside plastic clamping sleeves, the individual glass fibres having been fused together using portable tools. The facility is currently transmitting 30 time-division multiplexed telephone conversations.—*Siemens.*

Backing for optical fibres research

☐ Research into optical communications has received additional support from the United Kingdom Post Office (UKPO) which is providing financial backing for a Chair of Optical Communications at Southampton University. The first holder of the new post is Professor Alec Gambling, formerly head of the University's Department of Electronics.

At the same time, Dr. John Midwinter, head of optical communications studies at the Post Office's Research Centre at Martlesham Heath, is made a visiting professor at the University.—*UKPO.*

Teleconference experiment in Canada

☐ The Telecommunication Services Branch, Ontario Ministry of Government Services, is experimenting with colour television conference communications between Toronto and Thunder Bay, Ontario, 1386 km to the north-west, in co-operation with Bell Canada.

The company has installed transportable conference units at pilot centres located at the Ministry's offices in Toronto, and the Ontario Government Consolidated Building in Thunder Bay. These centres are linked by Bell Canada's local broadband network coaxial cable system and Canadian communications *Anik-B* satellite, via earth stations located at Toronto and Thunder Bay.—*Bell Canada.*

New Canada—United Kingdom link reduces cost of data services

☐ Teleglobe Canada has announced the inauguration of a new public data transmission service which will dramatically reduce the cost of computer communications between Canada and the United Kingdom.

This service, the first in a series of international data services to be marketed by Teleglobe under the trade name *Globedat*, will interconnect Canadian and overseas public data networks utilizing both packet switching and circuit switching technologies.

Globedat will link the United Kingdom's packet switching service to the *Datapac* network of the Trans-Canada Telephone System (TCTS) and the *Infoswitch* network of Canadian National/Canadian Pacific Telecommunications through Teleglobe's international packet switching gateway in Montreal.

Customer charges are based on the volume of data transmitted and call duration.—*Teleglobe Canada.*

Norway's new satellite ground station

☐ One of the world's northernmost satellite earth stations, opened recently by the Norwegian Telecommunications Administration, was supplied by *A/S Elektrisk Bureau Telecommunication Systems.* It is situated in Isfjord on Svalbard (Spitzbergen) at 78.02° N. The station is connected to *NORSAT*, the Norwegian national satellite system. Norway is the only country in Western Europe with such a system. Communication from the main town on Svalbard, Longyearbyen, now goes via radio link to the Isfjord earth station and thence to the mainland earth station at Eik in Rogaland.

The station has at present 12 telephone channels, 12 telex channels and 2 data channels.—*Elektrisk Bureau.*

Digital earth stations ordered for business communications network

☐ An order for five satellite earth stations and related electronics products has been placed by American Satellite Corporation with Scientific-Atlanta, Inc. The order, in excess of 1 million US dollars, is the first received under a recent memorandum of understanding which provides for Scientific-Atlanta to become a supplier of digital earth stations for the satellite data exchange (SDX) service being offered by American Satellite to United States business firms.

The 10 m earth station provides complete 56 kbit/s capacity.

Business satellite communication is expected to be one of the fastest growing markets of the 1980s in the United States.—*Scientific-Atlanta.*

Microwave links in the Congo

☐ The Brazzaville—Ouesso—Impfondo microwave network, by which telephony and television are transmitted throughout the northern part of the Congo, was inaugurated on the occasion of the country's national

holiday by Colonel Denis Sassou Nguesso, the Head of State.

The towns of Brazzaville, Djambala, Gambona, Owando, Makoua, Ouesso and Impfondo are now connected by an automatic telephone network. Television programmes from Brazzaville are broadcast from the Ouesso and Owando transmitters supplied by *LGT*, a subsidiary of *Thomson-CSF*.

This link of 21 stations spaced over 950 km is equipped with Thomson-CSF radio relays. The last hop is a tropospheric link.—*Thomson-CSF*.

China marine satellite tests completed

☐ A marine satellite test programme for China has been successfully completed according to the co-ordinator, RCA Global Communications, Inc.

The programme, designed to evaluate China's use of the *Marisat* satellite system, included a series of tests on telex, voice, data and facsimile services in a variety of ship-to-shore, shore-to-ship and ship-to-ship configurations.

China plans to establish a formal Marisat training programme prior to its participation in Marisat.

Results of the tests were evaluated by China's Communications Engineering Institute and the China Electronic System Engineering Company. Magnavox Corporation provided the Marisat ship terminals utilized in the tests.—*RCA*.

Kuwait orders electronic AFTN switch

☐ The Directorate General of Civil Aviation of Kuwait has ordered a *Philips' Telecommunicatie Industrie BV* stored-program controlled AEROPP message and data switching system for installation in the aeronautical fixed telecommunications network centre at Kuwait international airport. Installation is scheduled for completion by November 1980. Value of the contract is approximately 1.2 million US dollars.—*Philips*.

Canada to participate in "L-Sat" development

☐ The Canadian Cabinet has authorized the Department of Communications (DOC) to participate in the complete definition phase of a programme to develop a large multi-purpose satellite *L-Sat* being planned by the European Space Agency (see *Telecommunication Journal*, March 1980, page 174).

The government may spend up to 2 million Canadian dollars or about 10% of the total cost of the definition phase.

Participation in the L-Sat programme will help ensure availability to Canadian industry of a heavy satellite to carry payloads for future communications missions such as direct broadcasting by satellite.—*DOC*.

"Satcom-3" replacement launch requested

☐ RCA American Communications, Inc., has filed with the Federal Communications Commission (FCC) for authority to launch a replacement for *Satcom-3*, which was lost on 10 December 1979, shortly after the apogee kick motor was fired. The new Satcom-3 will be positioned at 132° W longitude, and will carry cable television programming.

RCA Americom has indicated to the FCC its intentions to have an improved system to provide in-orbit restoration for failed transponders on its *Satcom-IV* satellite system.

The company expects to launch the Satcom-3 replacement in June 1981, and Satcom-IV in October 1981.—*RCA*.

Emergency communications equipment for Pakistan

☐ The Telecommunications Administration of Pakistan has placed an order worth 18 million kroner with *A/S Elektrisk Bureau Telecommunication Systems* of Norway. The equipment consists of 15 complete emergency communications terminals installed in 15 four-wheel drive Land Rover vehicles. Each terminal has a capacity of 24 telephone channels and a range of 50-80 km. These mobile communications centres are designed to provide instant communications in cases of flood or other natural disasters and thereby make rescue and relief activities even more effective.—*Elektrisk Bureau*.

Fivefold growth in telecommunications by year 2000 predicted

☐ Demand for telecommunication services in the United States, with an increasingly prominent role for space satellite video and data communications traffic, is expected to grow fivefold by the turn of the century, according to recent studies.

The studies, conducted for the United States National Aeronautics and Space Administration (NASA) by the US Telephone and Telegraph Corporation, New York, and by Western Union Corporation, show that demand for conventional voice services —message-toll service and private-line traffic— will continue to predominate.

By the turn of the century, as much as one-fourth of all long-distance voice traffic may be carried by satellites, as well as half of all data and video traffic.

The studies were done in conjunction with NASA's recently announced decision to renew programs directed at advanced communications satellite research and technology. Primary emphasis is on developing technology needed to open the 20/30 GHz frequency band for commercial use during the next two decades in a cost-effective and spectrum-conserving manner. The band has not so far been used in the United States.

The recently concluded studies show that by the early 1990s growing demand for long-distance telecommunications services will have saturated the existing United States domestic satellite capacity in the bandwidths at 4-6 and 11-14 GHz. To accommodate this expected rapid growth in demand, more versatile satellites that have higher capacity and operate in the 20/30 GHz band, as well as in currently used bands, will be required.

A major attraction of the 20/30 GHz band is the broad frequency range allocated to communications satellite use—five times the band allocated at the lower frequencies.

Using 20/30 GHz band, advanced technology satellite systems would have message capacities of 50 to 100 times those operating in the 4-6 GHz-band.

The studies conclude that by the year 2000 90% of all telecommunications traffic will require real-time, or instantaneous service.—*NASA*.

Rise in precious metal prices causes increase in the cost of electronic components

☐ The Beckman Instruments electronic products group, a supplier of passive electronic components, is increasing the prices of its lines of potentiometers and resistance networks to offset the rise in the price of gold, silver and other precious metals used in their manufacture. The increases announced range between 5 and 30%.—*Comark Europe*.

New telecommunications managers association formed

☐ A new professional association has been created whose members are involved in microelectronic-based telecommunications technology in business and commerce in the United Kingdom.

The new body, The Telecommunications Managers Association (TMA), part of the Institute of Administrative Management, reflects the growing importance of telecommunications and the increasing status of the professional telecommunications manager within the business environment.

Until recently, business telecommunication was centred around the telephone and telex. Now, new technology is opening the way to a vast range of new services and facilities such as facsimile, high-speed text communication, word processing, many forms of distributed computing, viewdata, video conferencing, and a whole range of new telephone-based services through the use of computer-controlled telephone exchanges.

It is the function of the telecommunications manager to provide the understanding of the technical, financial and social implications of this new technology to the company boardroom and the vital link at a professional level between his company, the telecommunications administration and the manufacturer.—*TMA*.

Communications policy vacancy at MIT

☐ The Massachusetts Institute of Technology has announced a position in communications policy. The appointment is expected to involve affiliation both with a department and the MIT Research Program on Communications Policy. Competence is needed in communications policy and economic analysis as well as political science. Either American or international focus is appropriate.

Prior experience in the field is required. Government or industry experience is welcomed. Responsibilities include research and teaching on policy issues regarding the organization and regulation of communications systems including telecommunications, mass media, and new communications technologies.

Current research may include regulatory issues regarding communications media in the face of technological change, social consequences of technological changes in communications, etc.

The rank is at the junior or middle level. Applications to: "Professor Nazli Choucri, Personnel Committee, Department of Political Science, MIT, E53-490, Cambridge, Massachussetts 02139 (United States)".—*MIT.*

Personnel changes...

... in Afghanistan

☐ Lt.-Col. Mohammed Aslam Watanjar has been appointed Minister of Communications.

Mr. Hayatullah Nasser has been appointed President of the Planning Department, replacing Mr. Ghaussuddin Tasmim.

... in Pakistan

☐ Mr. Yusuf Reza has been appointed Director General, Pakistan Telegraph and Telephone Department, replacing Mr. S. A. Siddiqi.

... at KDD

☐ Mr. Teru Hidaka has been elected Chairman of the Board of Directors and Mr. Motoichi Masuda has been elected President of the *Kokusai Denshin Denwa Co., Ltd.*

In brief...

☐ *Radiográfica Costarricense SA* (RACSA), the Costa Rican telex communications authority, has awarded *Philips Electronikindustrier AB* (PEAB), the Swedish-based division of *Philips*, a contract for the supply of **500 electronic telex terminals.** The order is valued at approximately 1.5 million US dollars.—*Philips.*

☐ The **"Constanera" EWS exchange** in Buenos Aires went **into operation** a short time ago. It is the first public exchange with stored-program control in Argentina.—*Siemens.*

☐ An **electronic voting system** recently came into operation at the European Parliament at Strasbourg. It now takes only a couple of minutes to obtain all the details of the outcome of every vote.

In fact, the system performs an immediate count, checking for any irregularities, and transmits the results on a video on the president's table and, on request, on illuminated boards visible all over the chamber; lastly it prints a report on the voting.

The system was supplied by *Olivetti.*—Olivetti.

☐ The United Kingdom Post Office has ordered 700 000 pounds sterling worth of **digital multiplex equipment** from GEC Telecommunications Limited.

As a result of these latest orders every Post Office main trunk digital terminal will contain GEC digital multiplex equipment to assemble individual signals into a composite 120 Mbit/s digital signal—equivalent to 1680 speech circuits—for transmission over 120 Mbit/s line systems, and to separate the received signals.—*GEC.*

☐ The *Compagnie industrielle des télécommunications* (CIT-Alcatel), a branch of the CGE Group, has just concluded an agreement with the British Vickers group to take over all the office machine activities of Roneo-Vickers comprised in the Roneo-Vickers Office Equipment Group.

☐ CIT-Alcatel and *Thomson-CSF* have agreed to take joint control of the *Locatel* company. They intend to develop the network for leasing television equipment, which is the basis of this company's activity, by extending it to include telematics products and services. This operation complies with the policy pursued by France, at the instigation of the PTT Administration, to take a primary place on this market which is bound to expand greatly during the next few years.—*CIT-Alcatel.*

☐ To accommodate increased expansion and further growth at BNR INC. (Bell-Northern Research), construction was recently started on a two-storey 15 000 m² building in Mountain View, California. Scheduled for completion mid-1980, the new building will have a maximum capacity of approximately 700 employees.

BNR INC. is a wholly-owned subsidiary of Bell-Northern Research, Canada.—*BNR INC.*

☐ The United States-based Warner Amex Cable Communications Company has placed a further **order for 100 000 cable television terminals** with Pioneer Electronic Corporation (Japan). The amount involved will be approximately 5 000 000 000 yen.—*Pioneer News.*

☐ The world-wide **market for automatic test equipment** (ATE) will reach 942 million US dollars in 1984, reflecting a compound annual growth rate of 9.6%. This forecast represents a slowing of the growth rate, which reached 17% during the 1973-1979 time period, according to an analysis of the ATE industry released by Creative Strategies International.—*CSI.*

☐ An order for an **outside broadcast vehicle** has been placed by Ulster Television, the Northern Ireland independent television programme company, with Sony Broadcast Ltd.—*Sony.*

Technical News

Installation of world's first deep-water optical-fibre-cored undersea telephone cable

☐ Installation testing has been completed by Standard Telephones and Cables Limited (STC) on what is believed to be the world's first optical-fibre-cored undersea telecommunications cable.

The trial 9.5 km loop of cable was laid by the British Post Office cableship *Iris* in Loch Fyne on the west coast of Scotland. The loch's relatively deep, tidal salt water is typical of the North Sea area where it is thought likely that undersea fibre optic communication cable systems will have their first commercial application.

One regenerator housing, with its mechanical terminations, has been laid with the cable, and at a later date this will be equipped with the necessary electronic regeneration equipment.

The cable will utilize a digital transmission system and will be capable of carrying telephone, television and data traffic.

The deep-water cable, designed and manufactured at STC's submarine systems division Southampton cable factory, contains six optical fibres and is armoured in the conventional manner.

It will take several years to develop the technology to the proven high reliability required of submarine cable systems. The aim is to produce high-capacity systems, compatible with the world's expanding digital networks at a lower cost than current analog systems.—*STC.*

Guide to graded index optical fibres

☐ A comprehensive compendium of graded index optical fibres has been published by Probe Research, Inc.

The study analyses all 78 different graded index fibre models currently on the market. Easy-to-understand tables provide at-a-glance answers for such fibre parameters as loss, bandwidth, numerical aperture, price, core diameter and fabrication method—up to 16 parameters in all—for each of the fibres.

In addition to the tables and explanatory text, the 60-page guide provides three special features:

1. A computer study revealing which fibres might be overpriced or underpriced.

2. A report on how to evaluate optical fibres —discrepancies such as macro/microbending, bandwidth differential, and limited phase space are analysed.

3. A discussion of the most recent fibre developments.

The study, *Graded index optical fibers—a complete guide*, is available for 95 US dollars from "Probe Research, Inc., PO Box 251, Millburn, New Jersey 07041 (United States)". Tel.: (212) 732-5417 or (201) 376-7730.—*Probe Research.*

Solar power units for rural use

☐ A contract to design and build prototype solar energy units for providing electrical energy to small communities and rural areas has been awarded by the United States National Aeronautics and Space Administration (NASA) to the General Electric Company's Space Division.

The 16-month, 1.2 million US dollar contract is the second part of a two-phase programme to develop a low-cost, point-focusing solar concentrator.

Under the contract, General Electric will build three dish-shaped solar thermal energy concentrators. Each concentrator will be 12 m diameter and will include the mechanism that allows the concentrator to track the Sun.

A point-focusing solar concentrator directs mirror-reflected solar radiation to a centrally located heat absorber connected to a heat-driven engine and generator. Heat absorbers and heat-engine generators for the installation are being developed under separate contracts.—*NASA.*

Development contracts for large wind turbines

☐ The United States National Aeronautics and Space Administration (NASA), under a Department of Energy sponsored programme, has selected the Boeing Co. and General Electric Co. for contract negotiations to design, construct, install and test advanced multi-megawatt wind turbine systems.

If the development programme meets its goals and if the machines are produced in quantity, they could generate electricity at costs comparable with conventional energy sources.

NASA is negotiating contracts with General Electric and Boeing for about 15-20 million United States dollars each for the 4 MW wind-turbine systems with blades 91 m or more from tip to tip.

The wind turbines will be designed for sites with an annual mean wind speed of 23 km/h.—*NASA.*

Study completed on free-flying "Spacelab" pallets

☐ British Aerospace Dynamics Group have recently completed a design study for the European Space Agency to assess the feasibility of using *Spacelab* pallets as the basic structure for an autonomous free-flying multimission spacecraft, or as elements of a space station.

The results of the study indicate that Spacelab pallets equipped with the necessary sub-systems would provide an economical general-purpose space platform of good utility for space projects.

British Aerospace Dynamics Group designed, developed and now supply pallets for the European Spacelab, to be carried into orbit by the United States National Aeronautics and Space Administration (NASA) Space Shuttle. Having developed the pallet for this purpose, the possibility exists of equipping it with the necessary sub-systems which will enable it to carry payloads and operate as a free-flying spacecraft.

Applications envisaged include astronomy, Earth observation and cosmic-ray research plus a large number of other scientific studies, many of which could be performed concurrently on the same flight.

Payloads of up to 4000 kg could be carried although loads between 1000 and 2000 kg would be more typical. Up to 3 kW of electric power could be supplied for the mission equipment.

A second role for the Spacelab pallet that was also studied was its use as a space station.

Experimental equipment mounted on pallets would be carried up into space by the Shuttle which would rendezvous with a power-module already in orbit and to which the pallet space station would be coupled. A NASA proposal exists to place a 25 kW power module in orbit for this purpose in 1984-1985. After the experiments had been completed the pallet space station would be retrieved and returned to Earth by the Shuttle.

The Spacelab pallet is a U-shaped structure some 2.93 m in length by 4.35 m wide and 2.24 m high equipped with 24 hard-points to which heavy concentrated loads may be secured plus 576 attachment points for lighter loads. To operate autonomously as a spacecraft the sub-systems that would need to be fitted to the pallet include:

— attitude and orbit control;

— a command and data handling module;

— a power conditioning and distribution network.

The particular shape of the pallet enables it to carry large-volume payloads and provides installed equipment with a wide angle-of-view out to space.

Half- and quarter-size pallets could be built for specific applications, if required.

Existing Spacelab pallets have been designed to survive an operational life of 50 missions flown over a period of ten years.—*British Aerospace.*

New "two for one" video transmission system experiment

☐ The scarcity of frequency allocations for microwave systems may be alleviated by a new "two for one" transmission system. A co-operative effort by RCA American Communications, Inc. and David Sarnoff Research Center engineers near Princeton, New Jersey, United States, has resulted in installation of a new video transmission system for experimental testing, conveying *two* new video channels within the same frequency band formerly assigned for *one*. The experiment is being carried out on RCA's microwave link between New York City and its satellite transmission facility at Vernon Valley, New Jersey.

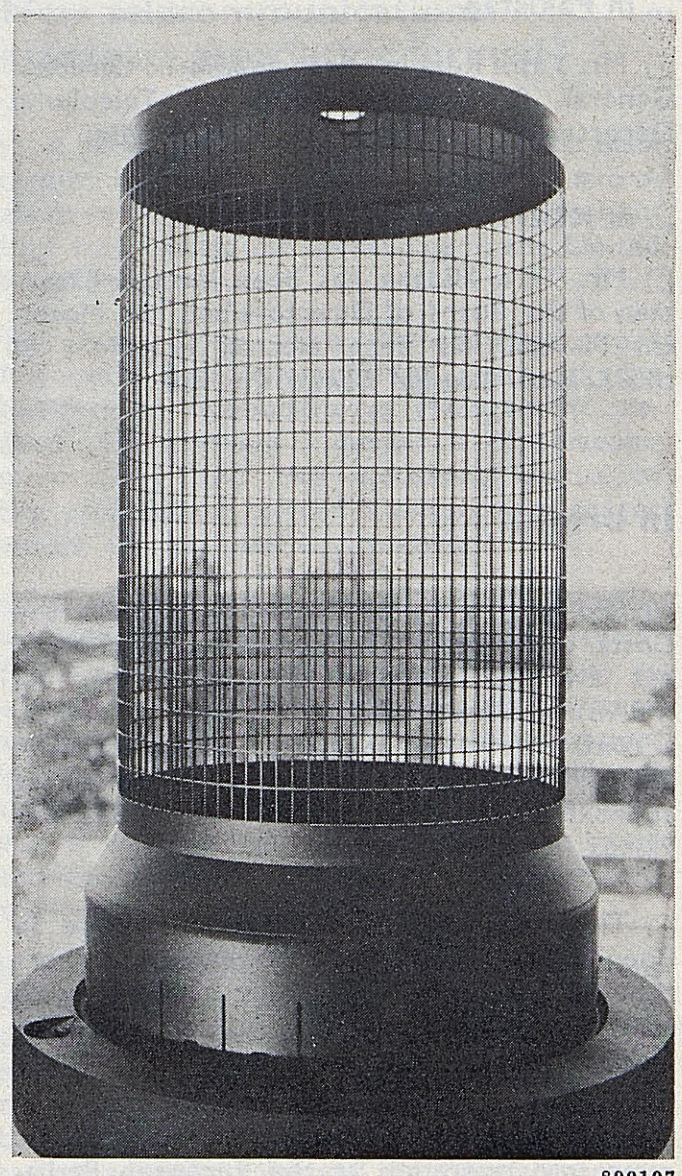
The dwindling availability of frequency allocations, especially in urban areas, has been aggravated by the increased use of satellites for distribution of television signals.

The ability to convey two video channels in the frequency band that formerly carried a single channel will allow users to double the capacity of video terrestrial transmission facilities without a corresponding increase in required frequency allocations.

The performance of the new system is reported to be comparable to that achieved with the prior transmission techniques. It yields high-quality television pictures that meet the requirements of the cable-television industry.—*RCA.*

Tube grids made from graphite: holes cut out by laser beam

☐ Transmitter tetrodes for radio can be miniature power stations. The largest specimens produce 1000 kW and even more. The cathodes heat up to about 2000 K, and the control grids are only slightly cooler. Only special designs can stand such thermal stress. *Siemens AG* makes use of material obtained pyrolytically from hydrocarbons which is deposited in cylindrical form up to the size of a waste-paper basket. The actual grid structure is obtained by means of laser beams. The remaining graphite bars have a thickness of only a few tenths of a millimetre.



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Tube grids made from graphite

Methane is an example of one of the hydrocarbons from which suitable graphite grids may be obtained. The gas is initially decomposed at 1900 K and higher temperatures, so that the resulting solid graphite can be deposited upon a cylindrical hollow body. When the graphite layer is carefully separated from the surface of the body, the basic structure of the graphite grid is complete. A laser beam cuts out the holes in the grid wall. This numerically-controlled optical tool produces a finely-carved grid pattern. In comparison with sand-blasted specimens the contours are smooth and dimensionally accurate.

This material, also known as "pyrographite", has proved itself in continuous operation to have great dimensional stability. In addition to this, graphite is a neutral material as regards emissions, thus does not emit disturbing secondary electrons as a result of thermal excitation or the action of any primary electrons produced. Both these effects can appear in grids made from wire or sheet metal if these are not specially treated. Graphite on the other hand also remains free of grid currents even at high transmitter power.

Siemens uses these graphite grids at the moment in transmitter tetrodes for short, medium and long waves.

Their external dimensions are comparatively small despite their high power, and the undesired stray capacitances also remain correspondingly small. Owing to their high power density, heat dissipation is by the distillation-condensation cooling process.— *Siemens.*

SATELLITE LAUNCHINGS NOTIFIED DURING PERIOD 24 JANUARY TO 17 FEBRUARY 1980

Code name Spacecraft description	International number	Country Organization Site of launching	Date	Perigee * Apogee	Period * Inclination	Frequencies Transmitter power	Observations
Cosmos-1152	1980-6-A	USSR (Plesetsk)	24 Jan.	181 km 370 km	89.7 min 67.1°		High-resolution, long-duration reconnaissance satellite
Cosmos-1153	1980-7-A	USSR (Plesetsk)	25 Jan.	983 km 1031 km	105 min 83°		Navigation satellite
Cosmos-1154	1980-8-A	USSR (Plesetsk)	30 Jan.	634 km 671 km	97.3 min 81.3°		Electronic monitoring satellite
Cosmos-1155	1980-9-A	USSR (Plesetsk)	7 Feb.	206 km 422 km	90.4 min 72.9°		Medium-resolution reconnaissance satellite
KH-11	1980-10-A	United States US Air Force (Western Test Range)	7 Feb.	220 km 498 km	91.7 min 97.0°		Digital imaging reconnaissance satellite
Navstar-5	1980-11-A	United States (Western Test Range)	9 Feb.				Global positioning system navigation satellite. Replaces *Navstar-1*
Cosmos-1156 to Cosmos-1163 mass: 40 kg each	1980-12-A to 1980-12-H	USSR (Plesetsk)	12 Feb.	1450 km 1528 km	115.4 min 74.0°		Government communication satellites
Cosmos-1164	1980-13-A	USSR (Plesetsk)	12 Feb.	220 km 640 km	92.9 min 62.8°		
SMM 3-axis stabilized satellite; width: 1.20 m; length: 4 m; mass: 2315 kg; 2 fixed solar arrays (3 kW); Ni-Cd batteries	1980-14-A	United States NASA (Eastern Test Range)	14 Feb.	571.5 km 573.5 km	96.12 min 28.5°	2287.5 MHz (tracking and telemetry)	Solar Maximum Mission. Objectives: to measure solar radiation during the period of maximum solar activity. Carries gamma ray spectrometer, hard X-ray burst spectrometer, hard X-ray imaging spectrometer, ultraviolet spectrometer and polarimeter, X-ray polychrometer, coronograph/polarimeter and solar constant monitoring package
Tansei-4 (MS-T4)	1980-15-A	Japan Institute of Space and Aeronautical Science, Tokyo University (Kagoshima)	17 Feb.	517 km 672 km	96.5 min 38.7°	136.725 MHz (tracking) 400.45; 2280.5 MHz (telemetry)	Tests of new technology for future satellites and test of the new *M-3S* launcher

* Initial orbital data.

Sources: COSPAR, NASA, Specialized Press.

New Products

Spectrum analyser

□ A new spectrum analyser, the *TF2371*, has been introduced by Marconi Instruments.

The new analyser retains all the features of the firm's *TF2370* but extends the frequency range up to 200 MHz, useful in the fields of RF communications, broadcast, FDM, PCM, SSB, sonar, satellite communications, navigation systems and fixed and mobile radio for aircraft.

The analyser offers a display system which includes the electronic graticule—movable in frequency and amplitude directions to simplify the measurement of relative amplitude and frequency. An advantage of the display system is the digital store which may be split in two for simultaneous display of the updated signal and a stored image for " before and after " comparison purposes.

The flicker-free stored image will remain on the screen without fading or " blooming ", for as long as required. Furthermore, analysis of the stored signal can be carried out using a bright line cursor and frequency counter to identify signal components, spurious signals, amplifier and filter bandwidths.

Marconi Instruments Limited, Longacres, St. Albans, Hertfordshire AL4 0JN (United Kingdom). Tel.: St. Albans 59292

V.24 interface tester

□ A new CCITT Recommendation V.24 interface tester is introduced to the European market by *INTEREP*. The model *7100 DVM* is a self-contained V.24 interface tester for insertion between the data terminal equipment (DTE) via its 25-pin female connector located on the front of the unit and the data communications equipment (DCE) via the 25-pin male connector mounted at the end of a 200 mm flat cable on the rear of the unit. It permits the user to monitor all 24 interface signals (pin 1/101 frame ground connected to chassis of unit) to isolate and identify sources of trouble, such as out-of-spec signal levels, excessive loading, shorts, open circuits, etc.

800104

V.24 interface tester

The two LED indicators (red for positive and green for negative voltages) assigned to each of the 24-interface circuits clearly indicate the activity on the data circuits, whether the control signals are high or low and whether the clock signals are active.

The model 7100 DVM contains 24 switches which allow any of the interface signals (except pin 1/101 frame ground) to be interrupted, i.e. each interface circuit can be opened between the DCE and the DTE. One set of 24 test sockets is connected to the DCE interface, the other set to the DTE interface which permits the making of cross-overs loop-backs, etc., of the various circuits with the jumper leads provided with the unit.

The built-in digital voltmeter provides the facility to measure the exact negative and positive voltage levels on each of the V.24 interface circuits. The model 7100 DVM is delivered complete with batteries, jumper leads and carrying case.

INTEREP SA, 4, cours des Bastions, CH-1205 Genève (Switzerland). Tel.: +41 22 20 83 46. Telex: 22138

Thumbwheel switches for PCBs

□ The new E-series thumbwheel switches from *NV Philips* have been designed for direct mounting on printed circuit boards. There are four basic versions of 10-position switches, and three basic versions of 16-position switches. The 10-position types are available with one common output, or as coding switches 1-2-4-8 with binary output, complementary output, or binary and complementary output.

The switches measure only 20.3 mm² by 7.62 mm high. They are rated at 250 V AC 1 A, and will switch a current of 0.15 A into a resistive load. Life duration is 250 000 operations at 5 V, 10 mA.

NV Philips' Gloeilampenfabrieken, Elcoma Division, PO Box 523, 5600 AM Eindhoven (Netherlands). Telex: 51573

Laser telephoto receiver

□ The new *TM 4006* laser telephoto receiver has many attractive features, e.g. it is very light and compact and requires practically no maintenance, photographic material can be dry-developed and the amount of silver used in the process is very small. The telephoto is available in 20 seconds after transmission, and is automatically cut from a 150 m roll of paper.

Dr.-Ing. Rudolph Hell GmbH, Postfach 6229, D-2300 Kiel 14 (Federal Republic of Germany). Tel.: (0431) 2 00 11. Telex: 02 92 858

Datacom tester

□ A low cost, hand-held datacom tester for computer room and field use called *Linktest* has been introduced by Kapusi Laboratories. It isolates fault to modem, computer, telephone line, or terminal and has an MSI-based design. It is suitable for end-to-end or loop testing when installing and maintaining small networks and short-haul modems.

800101

Link test datacom tester

It counts bit errors to 999 and has a solid-state bias indicator. It reads turnaround RTS/CTS delay to 1999 and monitors CCITT V.24 Recommendation (RS 232C) interface by tristate level detectors. It has breakout test points and electronic selection of speed and functions. It has an auto re-synchronous 2047 and 511-bit pseudorandom test pattern and 300 to 19 200 bit/s asynchronous, up to 100 000 bit/s synchronous, operation.

A built-in automatic selftest checks every function and it is surge protected. The tester is designed for 110/220 V (switchable) AC operation. A 483 mm rackmounted version is also available.

Kapusi Laboratories, 2121 So. El Camino Real, San Mateo, California 94403 (United States). Tel.: (415) 573-5475. TWX: 910 374 3004

Frequency down-converter/ tracking receiver

□ The frequency converter/tracking receiver *CV-3595* from California Microwave is an integral part of the positioning section of shipboard satellite communication earth terminals.

The converter/receiver contains a dual channel frequency conversion section which down-converts RF input (7.25 to 7.75 GHz) signals to 70 MHz. The 70 MHz signals are routed to the rear panel and to the tracking demodulators. The tracking demodulators use narrow phase lock loops to recover amplitude information from the satellite beacon signals. Error signals are then sent to the antenna controller portion of the satellite communication set. Two down-conversion channels and two tracking demodulators are included within this one chassis, simplifying interfaces and minimizing required rack space.

California Microwave, Inc., 990 Almanor Avenue, Sunnyvale, California 94086 (United States). Tel.: (408) 732-4000. TWX: 910 339 9231. Telex: 35-2016

Light measuring instrumentation

☐ The *22XL* optical multimeter from Photodyne is suitable for fibre optic measurements; including LED or laser source power, cable loss, connector loss, splice loss, and receiver sensitivity. The 22XL has a 90 dB range,

800112

Model 22XL optical multimeter

from 2 mW to 1 pW. It features autoranging and dual channel ratio capability for comparing sources, cables, or receivers.

Photodyne, Inc., 5356 Sterling Center Drive, Westlake Village, California 91361 (United States). Tel.: (213) 889-8770. Telex: 181159

HF 5 kW transmitter

☐ The *RF-727* high frequency channelized transmitter from Harris Corporation, RF Communications Division, rated at 5 kW, is designed for ship-to-shore, ground-to-air, and point-to-point service from 1.6 to 30 MHz. It is ideally suited for remote-controlled operation on up to 10 pre-set frequencies.

Key features of the RF-727 include full power into 3:1 VSWR antennae, five standard modes of operation, field programmability for new frequencies or modes, and channel changes in 0.2 second. Modular plug-in construction, conservatively rated components, and all solid-state design except for the final power amplifier provide high reliability. Channels, modes and functions can be remote-controlled over multi-wire cable or voice-grade telephone line.

Harris Corporation, RF Communications Division, 1680 University Avenue, Rochester, New York 14610 (United States). Tel.: (716) 244-5830. Telex: 978464

Intelligent multipen plotter provides high quality drawings

☐ An intelligent multipen digital plotter which can provide high quality technical drawings up to ISO A3 has been launched by Philips Test & Measuring Instruments. The *PM 8151* offers a programmable choice of 8 pens including standard draughting pens and different colour felt tip pens.

Microprocessor control allows linear interpolation for vector generation, absolute and relative plotting as well as circles and arcs —clockwise or anticlockwise. Up to 120 different characters—upper or lower case—can be printed using five different fonts.

Either CCITT V.24 Recommendation serial or IEC 625/IEEE 488 bus interfacing is available. An 800-byte buffer—optionally extendable by another 1 kbyte—provides storage for incoming data. A ROM expansion allows addition of special characters as well as user-defined sub-routines to the standard available software.

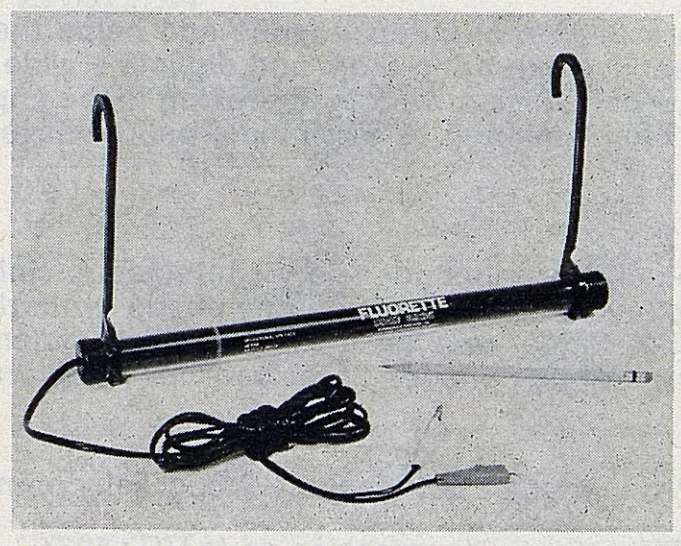
Apart from identification of plotted graphs in different colours and line thicknesses, it is possible to command five point centred marks and many different line types to distinguish lines. A high 15 Hz pen lift frequency ensures that even at plotting speeds, dotted or broken lines are reproduceable.

The unit operates on 110, 220 or 240 V AC ± 10% at 50 or 60 Hz with power consumption around 30 VA. The instrument measures 160 × 466 × 452 mm and weighs 13 kg.

NV Philips' Gloeilampenfabrieken, Science & Industry Division, PO Box 523, 5600 AM Eindhoven (Netherlands). Telex: 515 73

Portable 48 V DC fluorescent light

☐ A portable, self-contained, lightweight fluorescent light for use in telephone central offices or anywhere that 48 V DC power is available, has been introduced by Communication Mfg. Co. Designated the *CMC 3985 Fluorette*, the durable plastic lamp has two hooks which permit horizontal or vertical hanging for convenient placement. For comfort, a built-in reflector shield directs the glare-free white light onto the work area away from the user's eyes.



800113

The CMC 3985 Fluorette

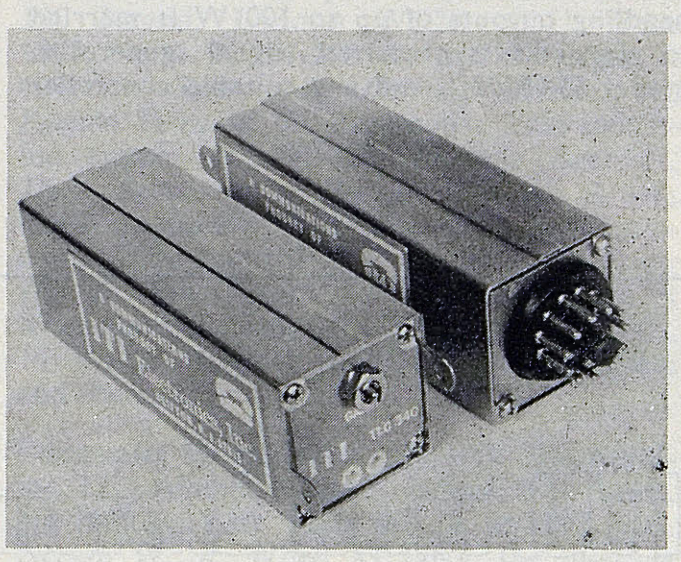
To prevent accidental burn-out, power input is protected against reverse polarity. Additionally, insulated power clips on the 2.4 m long cord are colour-coded to indicate polarity.

The lamp has a built-in high frequency converter, eliminating the usual cord transformer associated with other portable fluorescent lights.

Communication Mfg. Co., 330 East Spring Street, PO Box 2708 Long Beach, California 90801 (United States). Tel.: (312) 426-8345

Low-cost line amplifier

☐ An addition to its voice frequency communication products line, the *TLC 340* line amplifier, has been announced by ITI Electronics.



800102

The TLC 340 line amplifier

The amplifier is intended for private line conditioning and provides up to 39 dB of gain with maximum output of 15 dBm at 0.5% harmonic distortion.

ITI Electronics, Inc., PO Box 260, 369 Lexington Avenue, Clifton, New Jersey 07011 (United States). Tel.: (201) 546-3900. TWX: 710 989 7261

New AM universal "Pocketfone"

☐ The Pocketfone *P5001* is a new VHF AM multi-purpose portable transceiver from Pye Telecommunications. The single unit combines both body-worn and hand-held applications without degrading performance or operating efficiency in either mode. Changing from one mode to the other is simple; the quick-release holster which secures the Pocketfone is equipped for rapid, automatic switching of the essential send/receive facilities to or from the loudspeaker unit which may be clipped to the lapel of a coat.

Operational flexibility is further extended by its ready adaptability for use inside vehicles. A vehicle adaptor, type *BC25*, has been designed to accept the portable, making automatic connection to the vehicle antenna, a rapid charge facility powered from the vehicle supply, and a high power audio amplifier. The installation, completed by a standard mobile microphone and loudspeaker, gives the equipment mobile performance with enhanced operating range.

The transceiver is available for bands in the frequency range 68-174 MHz. Single and up to six-channel versions are available. Transmitter output power is 1 W.

Pye Telecommunications Ltd., St. Andrews Road, Cambridge CB4 1DW (United Kingdom). Tel.: (0223) 61222

Transmitter test set

☐ A programmable system for testing mobile communications transmitters and receivers in the VHF and UHF bands up to 520 MHz has been developed by the Telecommunications Division of Farnell Instruments.

The system can be controlled by a low-cost desk computer to perform comprehensive sequential test routines automatically with minimum manual involvement and is designed to improve production or service throughput.

The transmitter test set *TTS520* capable of handling outputs of up to 100 W is married to Farnell's synthesized signal generator, model *SSG520BD*, and any suitable controller using an IEEE 488 interface module. These three instruments are designed to stack or rack and form a compact composite system. The TTS520 incorporates an RF counter, an automatic modulation meter, a directional RF power meter, an AF voltmeter, an AF synthesizer, a distortion analyser, an AF counter, weighting filters and an RF power load/attenuator.

Among the measurements that the system can handle are: transmitter frequency, power and modulation level, capability, sensitivity, bandwidth, distortion and frequency. Also transmitter continuous tone modulation checks and measurement of antenna efficiency may be carried out. On the receiver, measurements can be made of frequency, bandwidth, and demodulation—capability, sensitivity, bandwidth, distortion, frequency and sensitivity tests by the SINAD or quieting method. Signal to noise tests and continuous tone mute checks are also made easy.

Farnell Instruments Limited, Sandbeck Way, Wetherby LS22 4DH, Yorkshire (United Kingdom). Tel.: (0937) 63541

Channelized ARQ system

☐ The *RF-2330* channelized ARQ system is an advanced synthesized (transmitter/receiver) automatic error correcting radio teletypewriter system. A high-speed switch allows operation from a single antenna. It can be operated in either simplex or split channel (half duplex) modes.

The RF-2330 is a complete system that features 1 kW PEP or average, microprocessor control, switched simplex operation, high frequency stability and channelized full frequency coverage. It includes all elements necessary for operation including the basic transmitter, *RF-233*; receiver, *RF-530*; HAARQ modem, *RF-3500*; antenna coupler, *RF-1205*. The teletypewriter is available as an option.

Harris Corporation, RF Communications Division, 1680 University Avenue, Rochester, New York 14610 (United States). Tel.: (716) 244-5830. Telex: 978464

ITU Film Library

Ref. ITU-216

Pays — Country — País: ROYAUME-UNI — UNITED KINGDOM — REINO UNIDO (1977)

Titre — Title — Título: LIFE LINE (La ligne de vie — Línea vital)

Format — Size — Tamaño: 16 mm

Durée — Duration — Duración: 22 min

Langue — Language — Idioma: anglais — English — inglés

Observations — Remarks — Observaciones: couleur — colour — color

Sujet — Subject — Asunto:

Le téléphone donne aux handicapés un certain degré d'indépendance et la possibilité de nouer des contacts sociaux. Le film montre ce que le service téléphonique peut leur apporter et décrit toute une série de dispositifs auxiliaires conçus à leur intention. Il montre aussi les travaux qu'accomplit le *Post Office* pour perfectionner ces dispositifs et en inventer de nouveaux. On voit que, malgré leurs déficiences physiques, des êtres humains peuvent vivre de façon utile et constructive en s'aidant d'appareils téléphoniques complétés par de tels dispositifs.

Il s'adresse à tous les publics.

The telephone gives handicapped people a degree of independence and helps them establish social contacts. This film demonstrates the benefits the telephone service can bring them and depicts a wide range of auxiliary appliances designed specifically for them. It also illustrates the Post Office's work in improving these appliances and in developing new ones. It shows how, with the help of a telephone supplemented by such aids, people have been able to lead creative, purposeful lives despite their disabilities.

Audience: general.

El teléfono proporciona a los minusválidos cierta independencia y contactos sociales; esta película explica los beneficios que puede procurarles y describe una amplia gama de formas en que puede ayudarles específicamente. La película expone también los trabajos realizados por la *Post Office* para desarrollar nuevos sistemas de ayuda por medio del teléfono y muestra cómo valiéndose de éstos los minusválidos pueden llevar una vida creadora y significativa, pese a su incapacidad.

Carácter: general.

Editeur — Producer — Editor: Pacesetter Productions Ltd., for Post Office Telecommunications

Date d'arrivée à l'UIT — Date of arrival at ITU — Fecha de recepción en la UIT: 1977

Review of Reviews

A list of articles in other technical publications which may be of interest to readers of the Journal. The articles are listed under the language of the publication.

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Flux. Journal de la société des ingénieurs de l'Ecole supérieure d'électricité SUPELEC, 51, rue des Martyrs, 75009 Paris. Année 1980. **Février.** *(Numéro spécial: l'électronique et le monde médical).*

Informatique nouvelle (L'). 99, boulevard Jean-Jaurès, 92100 Boulogne-sur-Seine. Année 1980. **Février.** P. 24-25. *Posa J. G.* Pascal: la superstar des langages de programmation — P. 38-43. *Mandell M.* La fusion du traitement de texte et de l'informatique annonce le bureau du futur.

Inter électronique. Bimensuel des industries électroniques, 40, rue du Colisée, 75381 Paris Cedex 08. Année 1980. **N° 299.** P. 14. Restructuration du CNET: pour mieux orienter la recherche — P. 20, 29. La recherche en 1980: priorité aux passifs et aux circuits intégrés AsGa.

N° 300. P. 8-10. Mémoires à semiconducteurs: déséquilibre entre offre et demande — P. 14-15. Essais en vol de la centrale à gyromètre laser SV2 — P. 17. Triplement de la capacité de Transpac en 1980.

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Onde électrique (L'). Division électronique, radioélectricité et télécommunications (DERT) de la Société des électriciens, des électroniciens et des radioélectriciens (SEE), 120, boulevard Saint-Germain, 75280 Paris Cedex 06. Année 1980. **Janvier.** P. 13. De 50 kHz à 220 GHz, Tektronix maîtrise l'analyse spectrale hyperfréquences — P. 53-57. *Tamm P. U., Petit G.* Oscillateurs accordables par YIG: description et applications.

Février. P. 33-39. *Ségard N.* Télématique et société — P. 40-46. *Verrée J.* Introduction des systèmes de transmission numériques dans le réseau français des télécommunications.

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* This review is also published in French under the title *Revue de l'UER (Technique).*

** This review is also published in French, German and Spanish with the following titles: *Revue des télécommunications, Elektrisches Nachrichtenwesen* and *Comunicaciones Eléctricas.*

*** Formerly: " *ESA Scientific and Technical Review* ".

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Books

by A. El-Zanati

UMWELTBEDINGUNGEN, UMWELTPRÜFUNGEN [1]

Klimatische Umwelteinflüsse und Simulationsverfahren für die Erprobung technischer Produkte

(Environmental conditions, environmental testing—Climatic environmental effects and simulation processes for the testing of technical products), by Hans-Werner Bach and Hans Arnold Feil.

This book discusses the stresses to which a technical product may be exposed by its environment and the possibilities open for mastering them.

The subject is increasing in importance, particularly since technical products are to an even greater extent expected to remain in good working condition even in countries with climatic extremes. Even sensitive items, such as high precision mechanical or electronic devices, are expected to maintain the same level of reliability and service life world-wide as in their country of origin despite long-distance transport, adverse storage and assembly conditions and severe operating conditions. However, these requirements, which are already taken for granted, can only be met if constant efforts are made to maintain the highest standards of quality.

[1] *One bound volume; pp. 164; illustrations, tables, diagrams. 15×22 cm. Published by* Siemens Aktiengesellschaft, *Postfach 325, D-8520 Erlangen 2, 1979.*

THE RADIO AMATEUR'S LICENSE MANUAL [2]

by Wyland Dale Clift.

This volume offers a completely indexed set of the latest rules and regulations as set out by the Federal Communications Commission governing all modes of amateur radio operation.

Contents include: amateur licensing; the station license; passing the exam; the novice license; the technician license; the general class license; the advanced class license; the amateur extra class license; international regulations; US amateur regulations and answers to study questions.

[2] *One paperback volume; pp. 168; tables, diagrams. 21×28 cm. Published by* The American Radio Relay League, *Newington, Connecticut 06111, 1979. Price: 4 US dollars in the United States; 4.50 dollars elsewhere.*

TUTORIAL: COMPUTER-AIDED DESIGN TOOLS FOR DIGITAL SYSTEMS [3]

(2nd Edition) by W. M. van Cleemput.

This collection of papers originally appeared as the text for the tutorial on design automation that preceded the Fifth Annual Symposium on Computer Architecture. It emphasizes the aspects of design automation of most interest to computer architects.

Part I contains two papers: a survey of computer design methodology and its relationship to design automation tools, and a description of an integrated design automation system currently being developed at Stanford University. Part 2 deals with the subject of digital design languages, while Part 3 emphasizes architectural level description and Part 4 deals with the simulation of digital systems at a very high level. Finally, Part 5 deals with register and gate-level simulation techniques.

[3] *One paperback volume; pp. v+168; illustrations, tables, diagrams. 21×28 cm. Published by* The Institute of Electrical and Electronics Engineers, Inc., *345 East 47th Street, New York, NY 10017, 1979.*

IONOSPHERIC D REGION DISTURBANCES CAUSED BY SOLAR X-RAY FLARES [4]

by Mitsuo Ohshio.

The publication illustrates the sudden phase anomaly (SPA), one of sudden ionospheric disturbances, by the observational data of solar soft X-ray flux intensities, next the properties of observed solar X-ray flares and also the aspect of temporal and spatial variations in electron densities enhanced mainly in the ionospheric D region caused by disturbances with the solar flare type.

Contents include: procedure of analysis; adoption of fundamental physical quantities; relation between maximum enhanced solar X-ray flare flux intensities and SPA's; time variation of SPA's; properties of observed X-ray flares; electron density produced by solar X-ray flares; etc.

[4] *One paperback volume; pp. 346; tables, diagrams. 18×26 cm. Published by* Radio Research Laboratories, *Ministry of Posts and Telecommunications, 4-2-1 Nukui-Kita, Koganei, Tokyo, 184, 1978.*

LOCAL TELEVISION: PIPED DREAMS? [5]

by Andrew Bibby, Cathy Denford and Jerry Cross.

Though local radio in the United Kingdom is set for a major expansion, very few people have heard of the experiments taking place there in highly localized television. The authors of this book have worked at the two "community access" cable television stations at present operating: Andrew Bibby and Cathy Denford with "Channel 40" in the new town of Milton Keynes, and Jerry Cross with "Swindon Viewpoint". Although some attention has been given to the subject by journalists or academics in the field, this is the first major study produced by the station workers themselves.

[5] *One paperback volume; pp. 62; illustrations. 15×21 cm. Published by* Redwing Press, *11 Spencer Street, New Bradwell, Milton Keynes, 1979, and available from* Centre for Advanced TV Studies, *42 Theobald's Road, London WC1X 8NW. Price: 1.35 pounds sterling.*

THE ARRL ANTENNA ANTHOLOGY [6]

by Marian S. Anderson.

This anthology provides a compilation of antenna construction articles directed toward the beginner and experienced radio amateur interested in maximum performance for minimum expense, giving all the necessary information for building, tuning and installing over two dozen types of antennae.

Contents include: vertical antennas; Yagi antennas; quad antennas; miscellaneous antenna types; antenna theory and test methods.

[6] *One paperback volume; pp. 151; illustrations, tables, diagrams. 21×28 cm. Published by* The American Radio Relay League, *Newington, Connecticut 06111, 1979. Price: 4 US dollars in the United States; 4.50 dollars elsewhere.*

FIRST CLASS COMMERCIAL FCC LICENSE STUDY GUIDE [7]

by Victor Veley (*TAB Books* No. *1092*).

This study guide for those who want to obtain the highest commercial radiotelephone licence of the United States Federal Communications Commission (FCC) provides data needed to pass the Element 4 Advanced Radiotelephone Examination. It is both a question-and-answer guide, as well as a practical compendium of detailed data covering the answer to every possible question appearing in the test. Each chapter contains problems—with their solutions—to explain fully the principles involved, and each leads from the simple through the more difficult. Then, as a review of the new knowledge learned, and to build up confidence, practice problems appear at the end of each chapter. A whole chapter is devoted to the FCC *Rules and regulations*.

[7] *One bound volume; pp. 378; tables, diagrams. 13×22 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1978. Price: 12.95 US dollars.*

HOW TO DESIGN, BUILD AND PROGRAM YOUR OWN WORKING COMPUTER SYSTEM [8]

by Robert P. Haviland (*TAB Books* No. *1111*).

This guidebook describes how to build and program a computer for personal use, not intended for business or mass data handling operations.

Contents include: a home-built computer—the basic approach; main-frame construction: peripherals and input/output programming; the central processor: address programming; the read/write memory board: building your operating system; expanding your computer; etc.

[8] *One bound volume; pp. 308; illustrations, diagrams. 13×22 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1979. Price: 12.95 US dollars.*

THE GIANT BOOK OF AMATEUR RADIO ANTENNAS [9]

by the Editors of *73 Magazine* (*TAB Books* No. *802*).

This guidebook explains how to build, install, set up, and operate all types of ham radio antennae. Each of the units included offers effective communications abilities, and versatility as well. Wherever possible, the operation of each antenna in *actual* amateur radio operation is described. For the more advanced ham, a special chapter on antenna theory and history is included. The antenna—more than any other component in the transmitting/receiving system—will determine the effectiveness of the system. So, for any radio amateur wishing to learn about the antenna, this book will prove of immense value.

[9] *One bound volume; pp. 462; illustrations, tables, diagrams. 13×22 cm. Published by* TAB Books, *Blue Ridge Summit, Pennsylvania 17214, 1979. Price: 12.95 US dollars.*

Telephilately

1978—PANAFTEL—Pan-African Telecommunication Network—Airmail

CONGO

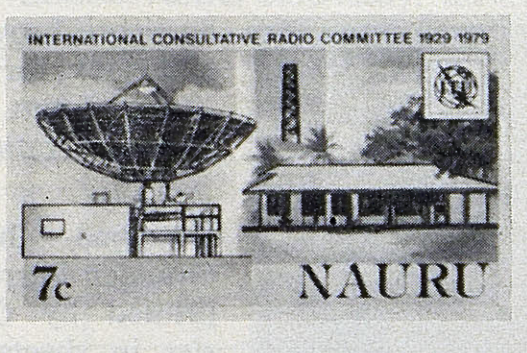
100 F, red, green and ochre; format: 31×52 mm (vertical); perforation 13.

Engraved by Quillivic.

1979—50th Anniversary of the International Radio Consultative Committee

NAURU

7c, multicoloured (satellite earth station); 32c, multicoloured (telex); 40c, multicoloured (maritime radio); format: 47 × 29 mm (horizontal); perforation 14½.



Printed by *Format International Security Printers Ltd.* in sheets of 25 stamps.

Europa 79

BELGIUM

14 F, polychrome; format: 44.5 × 24.5 mm (horizontal); perforation: 11½.

Designed by O. Bonnevalle and engraved by C. Spinoy (copperplate) and *Ets. J. Malvaux* (photogravure), three million copies of this stamp have been printed by the *Atelier du timbre* at Malines in sheets of 25. The date of issue was 30 April 1979. The design represents telecommunications from semaphore to the satellite.

An 8 F stamp in the same series presents a postal theme.

GUERNSEY

8p, ochre, brown, blue and black; format: 29 × 48.2 mm (vertical); perforation 11½ × 11¾.

Designed by R. Granger Barrett and printed by *Courvoisier* in sheets of 20 stamps on paper containing brown and green silk threads.

The design shows a telephone of the type used in Guernsey when the telephone service was inaugurated in 1897 together with a modern telex machine.

Date of issue was 8 May 1979.

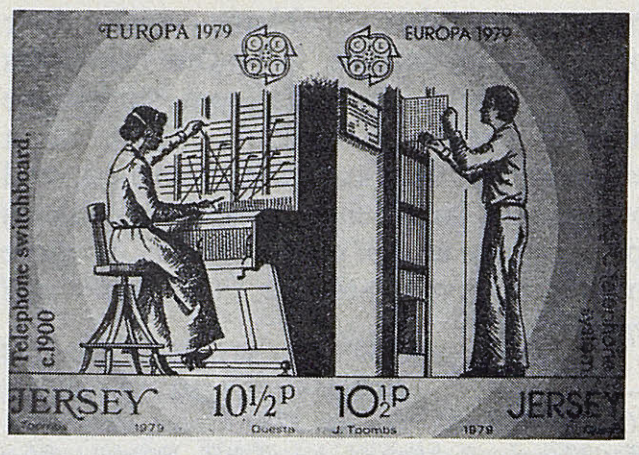
A 6p stamp in the same series represents a postal theme.

JERSEY

10½p, *(a)* violet, black and silver; 10½p, *(b)* blue, black and silver.

Both stamps are 26 × 34 mm (vertical); perforation 14½.

Designed by Jennifer Toombs, the stamps were printed *se-tenant* by the *House of Questa*, London, in sheets of 20.



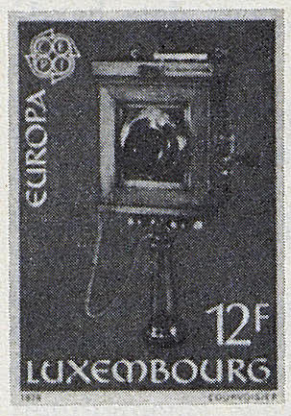
Stamp *(a)* shows a plug-in switchboard of the type used by the National Telephone Company in 1903.

Stamp *(b)* represents a modern SPC system as used by the States of Jersey Administration at the present time.

Two 8p *se-tenant* stamps in the same issue represent a postal theme.

Date of issue was 1 March 1979.

LUXEMBOURG



12 F, yellow, reddish brown, olive green, bluish black; format: 25.7 × 36 mm (vertical); perforation 11½.

Printed by photogravure in sheets of 50 on paper containing silk threads by *Courvoisier*.

The wall telephone set shown on the stamp was made by Schaeffer & Montanus of Frankfurt and was in service in the late 19th and early 20th centuries. After the introduction of the telephone service in Luxembourg by the Act of 20 February 1884, the number of phones of all kinds in the country was about 1600 in 1900, 23 000 in 1950 and 185 000 at the end of 1977, i.e. about 44 telephones per 100 inhabitants at the present time.

Date of issue was 30 April 1979.

A 6 F stamp in the same series represents a postal theme.

1979—World Telecommunication Day 17 May 1979

UPPER VOLTA

70 F, multicoloured; format: 28 × 38 mm (vertical); perforation 13 × 13¼.

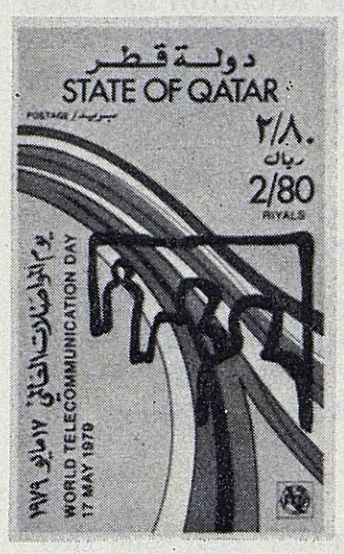
Official ITU design printed on glossy paper by *Edila*.

MALI

120 F, multicoloured; format: 28 × 38 mm (vertical); perforation 13.

Official ITU design printed on glossy paper by *Edila*.

QATAR



2/00 riyals, light brown, yellow, blue, magenta, green and black;

2/80 riyals, light green, yellow, blue, magenta, green and black.

Overall dimensions of both stamps are 30.4 × 47.9 mm (vertical); perforation 14 × 13½.

Both stamps are based on the official ITU design. Printed in sheets of 25.

TELECOM 79—3rd World Telecommunication Exhibition, Geneva

UPPER VOLTA

200 F, multicoloured; format: 52 × 40 mm (horizontal); perforation 13 × 12½.

Designed by R. B. Sawadogo and printed on glossy paper by *Edila* in sheets of 25.

INDONESIA

150 R, orange, prussian blue and grey; format: 32.1 × 24 mm (horizontal); perforation 12½.

Printed in sheets of 100. Based on the official ITU design.

TUNISIA

150 millimes, multicoloured; format: 25.7×41.1 mm (vertical); perforation 11½.

Designed by Ali Bellaghar; offset printed by *Courvoisier* (Switzerland) in sheets of 25 stamps.

Date of issue was 20 September 1979.

URUGUAY

N$ 10, yellow, mauve and black; format: 50×29 mm (horizontal); perforation 12×11½.

◄

Designed by Alvarez Cozzi and printed at the *Imprenta Nacional* on watermarked paper.

Note from the CCIR

Basic Indices for Ionospheric Propagation

THE FOLLOWING TABLES, giving values of the basic indices for ionospheric propagation, have been prepared by the Specialized Secretariat of the International Radio Consultative Committee (CCIR) in accordance with Resolution 4-2 and Recommendation 371-3 of the XIVth CCIR Plenary Assembly (Kyoto, June 1978). In order to expedite the dissemination of the predictions the CCIR Secretariat prepares a monthly circular which is sent to administrations, about the 10th of each month, in conformity with the conditions given in circular letter No. A.C./131 of 14 February 1969 Copies of these predictions may be obtained, free of charge, from the Director of the CCIR, ITU, Place des Nations, CH-1211 Genève 20, Switzerland.

Parameters:

R_{12} (smoothed mean, over twelve months, of the number of sunspots observed)

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1978	59	62	67	74	81	87	95	102	106	109	112	117
1979	123	130	136	141	147	154	156	157	157			

I_{F2} (ionospheric index) *

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1979	133	151	166	154	154	146	137	138	160	185	182	176
1980	145	143	158									

* *For further details, see the* Telecommunication Journal, *April 1964, page 119, and January 1966, pages 43-47.*

Φ (monthly mean value of solar noise flux at 2800 MHz at 17h00 UTC) **

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1979	203	204	186	173	165	180	166	173	200	218	231	203
1980	206	200	168									

** *Data kindly supplied by the National Research Council, Ottawa.*

Φ_{F2} (ionospheric index) ***

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1979	185	197	210	191	183	182	171	169	185	204	207	205
1980	200	191	197									

*** *For further details, see the* Telecommunication Journal, *September 1967, pages 354-356, and December 1968, pages 678-679.*

See also: Joachim M.: "Korrelation der Werte des solaren Index Φ und des ionosphärischen Index Φ_{F2}"—*Kleinheubacher Berichte*, Vol. **17** (1974), pages 369-374.

Predictions:

R_{12} ****

Year \ Month	4	5	6	7	8	9
1980	146	144	141	139	137	134

**** *Data kindly supplied by Dr. A. Zelenka, Federal Observatory, Zurich.*

Estimated error in forecasts of R_{12} six months in advance: ±9.

I_{F2} *****

Year \ Month	4	5	6	7	8	9
1980	156	158	159	159	157	(155)

***** *Data kindly supplied by the Science Research Council, Appleton Laboratory, Slough.*

The figure in brackets is the value predicted six months in advance.

Φ ******

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1980				204	210	210	205	199	196	193	188	181
1981	173	170	176	187								

Φ_{F2} ******

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1980				192	193	192	189	187	187	187	186	181
1981	175	173	176	184								

****** The prediction method elaborated within the CCIR Secretariat has, once again, been slightly modified since September 1979. The method was verified by comparison of measured and predicted data from October 1977 till the present time. A publication on these modifications will appear after verification of the method through several additional months.

Official Announcements

PARTIAL REVISIONS OF THE RADIO REGULATIONS AND THE ADDITIONAL RADIO REGULATIONS, GENEVA, 1959

FINAL ACTS OF THE WORLD MARITIME ADMINISTRATIVE RADIO CONFERENCE, GENEVA, 1974

The Government of **Greece** has approved the above-mentioned Acts.

REGIONAL AGREEMENT CONCERNING THE USE BY THE BROADCASTING SERVICE OF FREQUENCIES IN THE MEDIUM FREQUENCY BANDS IN REGIONS 1 AND 3 AND IN THE LOW FREQUENCY BANDS IN REGION 1 (GENEVA, 1975)

The Government of the **Socialist People's Republic of Albania** has acceded to the above-mentioned Agreement.

PARTIAL REVISION OF THE RADIO REGULATIONS, GENEVA, 1959

FINAL ACTS OF THE WORLD ADMINISTRATIVE RADIO CONFERENCE ON THE AERONAUTICAL MOBILE (R) SERVICE, GENEVA, 1978

The Government of **Ireland** has approved above-mentioned Acts.

INTERNATIONAL RADIO CONSULTATIVE COMMITTEE (CCIR)

INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE (CCITT)

The **Asia-Pacific Telecommunity (TAP),** Bangkok, has been admitted to take part in the work of the CCIR and the CCITT in an advisory capacity as a regional telecommunication organization.

With the approval of the Belgian Administration, **SWIFT (Society for Worldwide Interbank Financial Telecommunication SC),** Brussels, has been admitted to take part in the work of the CCITT as an industrial organization.

VACANCY NOTICES

Circular letters which have been sent to all Members of the Union announce the following vacancies:

• a post of **chief of Regional Division (Asia and Pacific), grade P.5,** in the General Secretariat; entry on duty: as soon as possible (circular letter No. 345 of 12 February 1980; vacancy notice No. 2-1980 ITU; final date for submission of applications: 12 May 1980);

• a post of **engineer, grade P.5,** in the Specialized Secretariat of CCIR; entry on duty: as soon as possible (circular letter No. 352 of 31 March 1980; vacancy notice No. 3-1980 ITU; final date for submission of applications: 30 June 1980).

Only applications forwarded through administrations can be taken into account; detailed applications with ITU personal history forms should be submitted to the General Secretariat of the ITU, Place des Nations, CH-1211 Genève 20 (Switzerland), not later than the final dates mentioned above.

TECHNICAL CO-OPERATION

Recruitment of experts

Circular letters which have been sent to all Members of the Union announce the following vacancies:

• three posts, namely:

— one post of **senior instructor in local line plant,**

— one post of **senior expert in management services,**

— one post of **expert in management services,**

to be filled as soon as possible for one year with possibility of extension at the Emirates Telecommunication Corporation (EMIRTEL), United Arab Emirates. Duty stations: Sharjah, with possibility of travel within the country for the first post; Abu Dhabi for the other two (circular letter No. 348 of 14 March 1980; field vacancy notices TC 14/80 UAE-510, TC 15/80 UAE-511 and TC 16/80 UAE-512; final date for submission of applications: 6 June 1980);

• two posts of **regional expert** (for all developing countries in Asia) in:

— **planning of sound and television broadcasting services**, to be filled in July 1980 for 18 months with possibility of extension, for the Economic and Social Commission for Asia and the Pacific (ESCAP). Duty station: Bangkok, Thailand (with travel within the region),

— **training in sound and television broadcasting engineering and operations,** to be filled in July 1980 for 18 months with possibility of extension, at the Asia-Pacific Institute for Broadcasting Development (AIBD). Duty station: provisionally Kuala Lumpur, Malaysia (with travel within the region),

(circular letter No. 349 of 17 March 1980; field vacancy notices TC 17/80 RAS-543 and TC 18/80 RAS-544; final date for submission of applications: 9 June 1980);

• one post of **senior training and maintenance expert in radiocommunications,** to be filled as soon as possible for one year, at the Post and Telecommunication Administration of the Republic of Equatorial Guinea. Duty stations: Malabo and Bata (circular letter No. 350 of 20 March 1980; field vacancy notice TC 19/80 EQG-516; final date for submission of applications: 12 June 1980).

Only applications forwarded through administrations can be taken into account; detailed applications with personal histories should be submitted to the General Secretariat of the ITU, Place des Nations, CH-1211 Genève 20 (Switzerland), not later than the final dates mentioned above.

CALENDAR OF ITU CONFERENCES AND MEETINGS

DATE	TITLE	PLACE
1980		
12-30 May	**35th Session of the Administrative Council**	**Geneva**
	International Radio Consultative Committee (CCIR):	
16-23 October	Interim Working Party PLEN/3 (Possible applications of broadcasting satellites)	Geneva
	(Interim Study Group meetings)	
2-20 June	Study Group 2 (Space research and radioastronomy)	Geneva
4-13 June	Study Group 7 (Standard frequencies and time signals)	Geneva
9-17 June	CMV (Vocabulary)	Geneva

DATE	TITLE	PLACE
16 June-4 July	Study Group 5 (Propagation in non-ionized media)	Geneva
18 June-3 July	Study Group 1 (Spectrum utilization and monitoring)	Geneva
23 June-8 July	Study Group 6 (Propagation in ionized media)	Geneva
29 September-16 October	Study Group 10 (Broadcasting service (sound))	Geneva
29 September-17 October	Study Group 11 (Broadcasting service (television))	Geneva
30 September-17 October	CMTT (Transmission of sound broadcasting and television signals over long distances)	Geneva
16 October-4 November	Study Group 4 (Fixed service using communication satellites)	Geneva
20-29 October	Study Group 3 (Fixed service at frequencies below about 30 MHz)	Geneva
20 October-6 November	Study Group 9 (Fixed service using radio-relay systems)	Geneva
26 November-19 December	Study Group 8 (Mobile services) *	
	International Telegraph and Telephone Consultative Committee (CCITT):	
	(Study Groups—Final meetings before the VIIth Plenary Assembly)	
25 April-1 May	Study Group XVII (Data transmission)	Geneva
2-9 May	Study Group XIV (Facsimile telegraph transmission and equipment)	Geneva
12-16 May	Study Group X (Telegraph switching)	Geneva
19-23 May	Study Group IX (Telegraph transmission quality; specification of equipment and rules for the maintenance of telegraph channels)	Geneva
28-30 May	GAS 5 (Economic conditions and telecommunication development)	Geneva
2-11 June	Study Group VIII (Telegraph and data terminal equipment, local connecting lines)	Montreal
9-20 June	Study Group I (Telegraph operation and quality of service)	Montreal
11-19 June	GAS 6 (Economic and technical aspects of the choice of switching systems)	Stockholm
10-21 November	**VIIth Plenary Assembly**	**Geneva**
	Joint Study Groups of the two CCIs:	
	CMTT (see under CCIR)	
	CMV (see under CCIR)	
	Seminars:	
	■ **Technical Co-operation Department:**	
5-16 May	Seminar on traffic engineering	Istanbul (Turkey)
—	Seminar on international tariffs **	—
23 June-4 July	Interregional seminar on the management of training	Kalmar (Sweden)
6-15 October	Seminar on maintenance of telecommunication networks	Colombo (Sri Lanka)
	■ **International Frequency Registration Board (IFRB):**	
24 November-5 December	Seminar on frequency management and the use of the radio frequency spectrum and the geostationary satellite orbit	Geneva

* Dates and place subject to confirmation.

** Dates and place to be given later.

ITU Publications

The following letters indicate the languages in which documents are published:

F *for French*
E *for English*
S *for Spanish*
R *for Russian*
C *for Chinese*

Prices are in Swiss francs.

Note

A comprehensive list of all the publications of the Union will be supplied free on request by the ITU General Secretariat, Geneva.

Publications issued since the last number of the Journal

List of addresses (6th edition—1st December 1979)

(ISBN 92-71-01071-X)

Trilingual edition, **F, E, S.**

Price (including the subscription to 7 supplements): 85 Sw.fr.

Price of ring-file (sold separately): 6 Sw.fr.

IFRB
International Frequency Registration Board

High frequency broadcasting schedule—September schedule 1978—S (1978)

Period: 3 September-5 November 1978

Trilingual edition **F, E, S.**

Forthcoming publications

List of ship stations (List V) (20th edition—1980)

Trilingual edition **F, E, S.**

List of international telephone routes (20th edition—1980)

Trilingual edition **F, E, S.**

List of radiodetermination and special service stations (List VI), Vol. II (7th edition—1980)

Trilingual edition **F, E, S.**

List of telecommunication channels used for the transmission of telegrams (3rd edition—May 1980)

Trilingual edition **F, E, S.**

Final Acts of the World Administrative Radio Conference (Geneva, 1979)

Separate editions in **F, E, S, R, C.**

Nineteenth Report by the ITU on telecommunication and the peaceful uses of outer space

Separate editions in **F, E, S.**

Table of international telex relations and traffic (position on 31 December 1979)

Trilingual edition **F, E, S.**

IFRB
International Frequency Registration Board

High frequency broadcasting schedules (quarterly)

Trilingual edition **F, E, S.**

Summary of monitoring information received by the IFRB

No. 204

Trilingual edition **F, E, S.**

CCIR
International Radio Consultative Committee

CCIR Atlas of ionospheric characteristics—Supplement No. 3 to Report 340

Trilingual edition **F, E, S.**

Supplement to CCIR Report 252-2

Separate editions in **F, E, S.**

CONDITIONS OF SALE

All documents ordered from the General Secretariat of the ITU must be paid for in advance. Documents must be paid for in Swiss francs when they are ordered.

Methods of payment:

1. **Switzerland:** to the postal cheque account of the ITU, GENÈVE 12-50
2. **All other countries:**

a) international postal order,
b) UNESCO coupon,
c) bank transfer to the Société de Banque Suisse, Geneva.

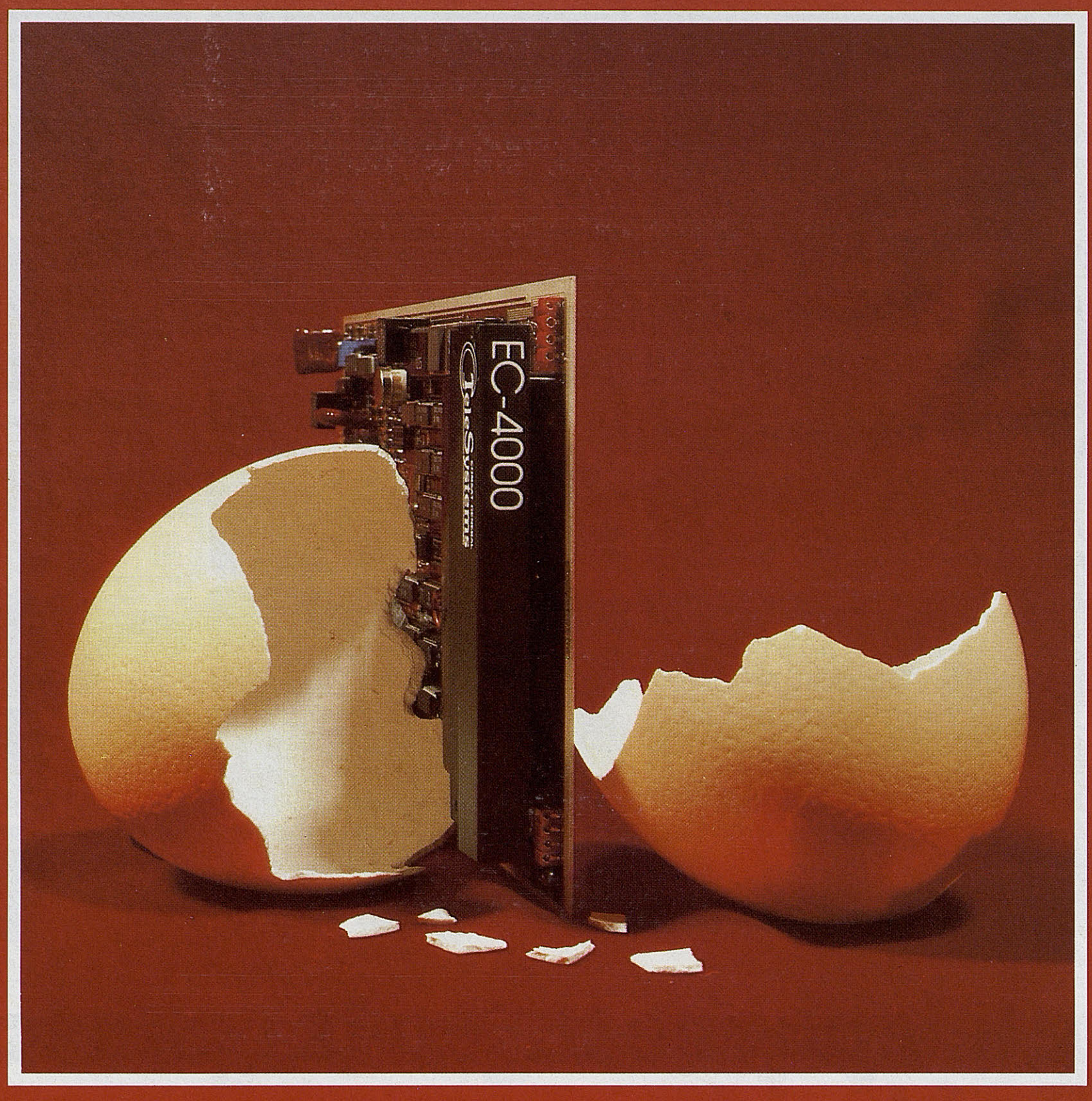
(Payment may also be effected by a cheque made out in another currency freely convertible into Swiss francs provided that the cheque, when cashed and converted, will cover the price of the publication in Swiss francs.)

Orders for documents and cheques must be addressed to:

International Telecommunication Union
Place des Nations, CH-1211 Genève 20 (Switzerland)

The prices quoted include packing costs and carriage by surface mail.

A FRESH IDEA



THE EC-4000 ECHO CANCELLER

You're looking at the new EC-4000 Echo Canceller.

From COMSAT General TeleSystems.

It features the most advanced digital echo cancelling circuitry available today.

Put it to work to eliminate problem echo in your long-distance satellite, undersea cable, and terrestrial circuits.

You don't need to add a special shelf to accommodate it.

We designed the EC-4000 to fit in standard equipment shelves without rewiring. To replace most echo suppressors quickly and economically.

The EC-4000 is more effective than any echo suppressor. It cancels echo cleanly, precisely. It introduces no noise into the circuits.

Completely self-adaptive even in the most dynamic environments, the EC-4000 requires no adjustment once installed. That's just one way it saves you money.

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The COMSAT Echo Canceller is field tested...field proven. It's performing in dozens of domestic and international telecommunications systems.

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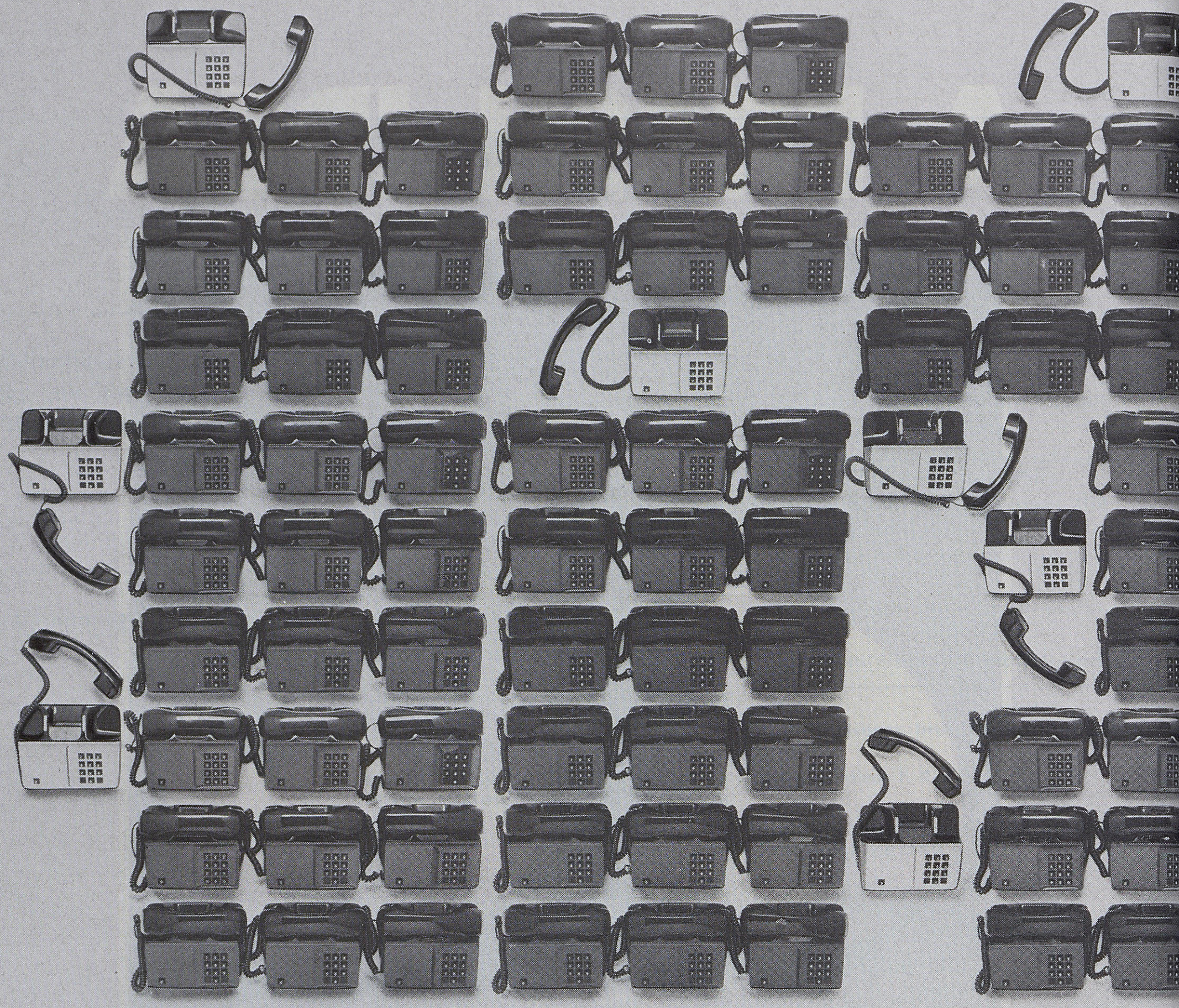
COMSAT GENERAL TeleSystems



One telephone in ten is connected to Ericsson. World wide.

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Because on one in ten of all the world's telephones, the calls you make go directly to an exchange designed by Ericsson. And that proportion is almost certainly rising.

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And direct subscriber connections are only part of the story. 1978 also saw transit exchanges installed with 300,000 terminations – roughly equivalent to another 1.5 million subscriber lines.

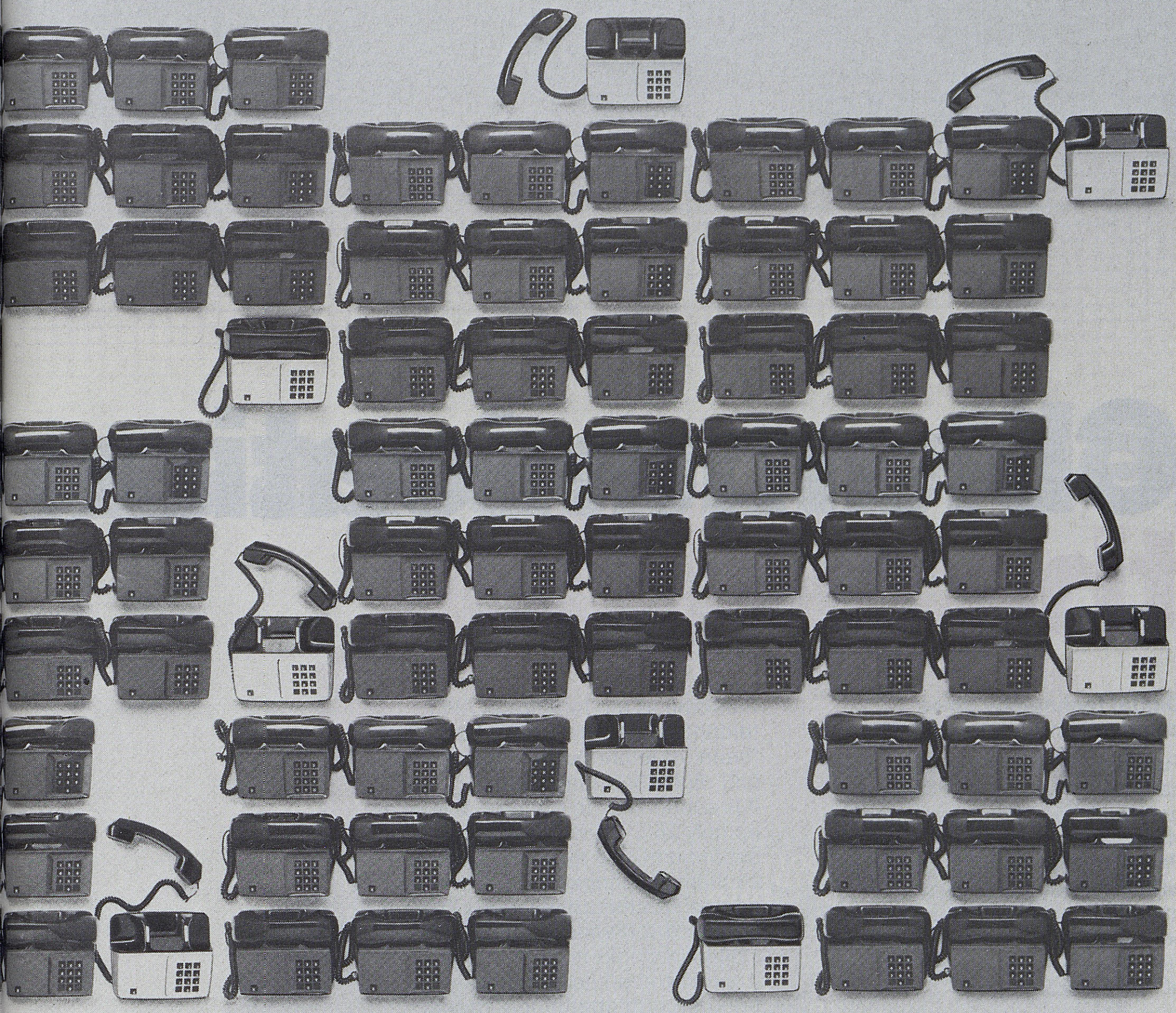
In all, Telephone Administrations in more than 80 countries have now installed exchange equipment of Ericsson design, and Ericsson Group sales of public telephone exchanges are now running at over $1 billion a year.

Our home market, Sweden, already has a highly-developed and comprehensive telephone system, and so accounts for only a tiny percentage of our sales– which means that Ericsson exchanges worth around a billion dollars were chosen by other countries. And that's a very remarkable figure, when you realise that only half the world is open to international competition.

No other supplier can match Ericsson's international market share.

How's it done? Simple. We develop the systems each country needs, and supply them in the way each country prefers.

Ericsson crossbar systems swept the world in the '50s and '60s. Quality was superb, reliability and life were exceptional, operational economy was outstanding. Now, in the '70s and '80s, Ericsson's digital AXE has emerged as the most successful computer-controlled telephone system on the world market. AXE is already on order or installed in over 23 countries – far more than any other digital system.



an exchange designed by Ericsson.

But wise Telephone Administrations pay as much attention to the future of the system they choose as to its technological brilliance. Ericsson systems have a guaranteed future. Digital technologies extend into a wide – and constantly-expanding – range of transmission systems, and into business and private subscriber equipment. To build up local know-how, and to make sure that any country gets the best out of systems installed, Ericsson concentrates on rapid technology transfer. Documentation is clear and full – and supplied in the local language. Staff training is extensive and comprehensive. Many of the 100 administrations who have adopted Ericsson technology have the assurance of local production: telecommunications equipment of Ericsson design is manufactured in 25 countries.

With no large home market to provide a convenient base for growth, Ericsson has to see the world as its home market. Ericsson systems have to be attractive and competitive everywhere. Ericsson achievement demonstrates that they are.

The Ericsson Group has a long tradition as supplier of complete telephone networks – exchanges, telephone sets, transmission equipment, cable, toll boards, etc. This tradition continues and now embraces complete digital public networks, including the AXE 10 digital switching system, PCM multiplex and digital multiplexes for pair cable, coaxial cable, microwave and optical fibre cable, and AOM 101 for centralized operation and maintenance.
In addition, Ericsson is one of the world's largest suppliers of telex and data switching and power equipment for public networks, and PABX and PAX and radio equipment. All products and systems are delivered individually or as complete turnkey packages.

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Siemens is in a unique position to offer digital technology because of its R & D and manufacturing activities in the fields of communications, computers and components. EWSD reflects the latest innovations in each of these sectors.

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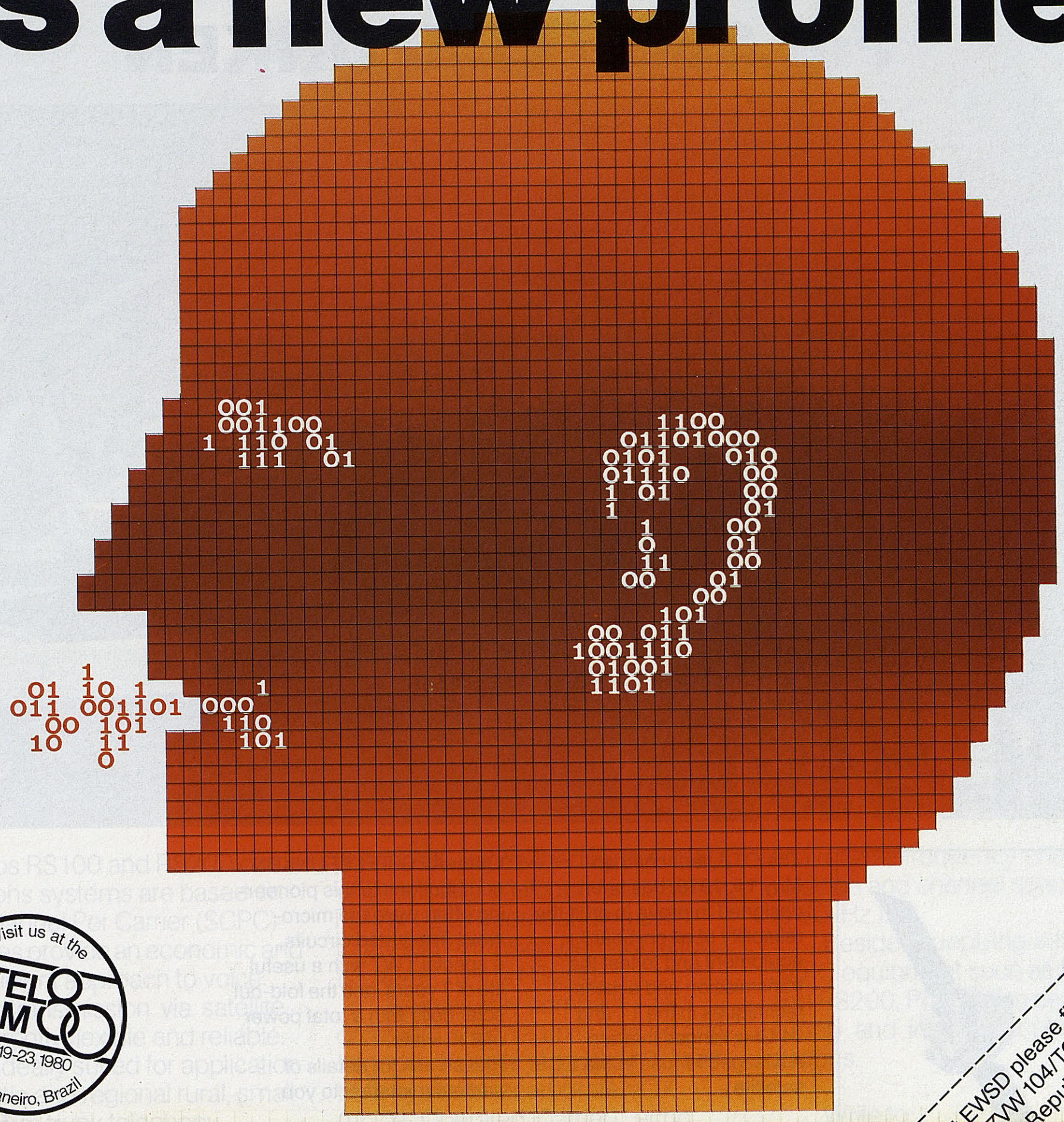

Visit us at the INTELCOM 80 May 19-23, 1980 Rio de Janeiro, Brazil

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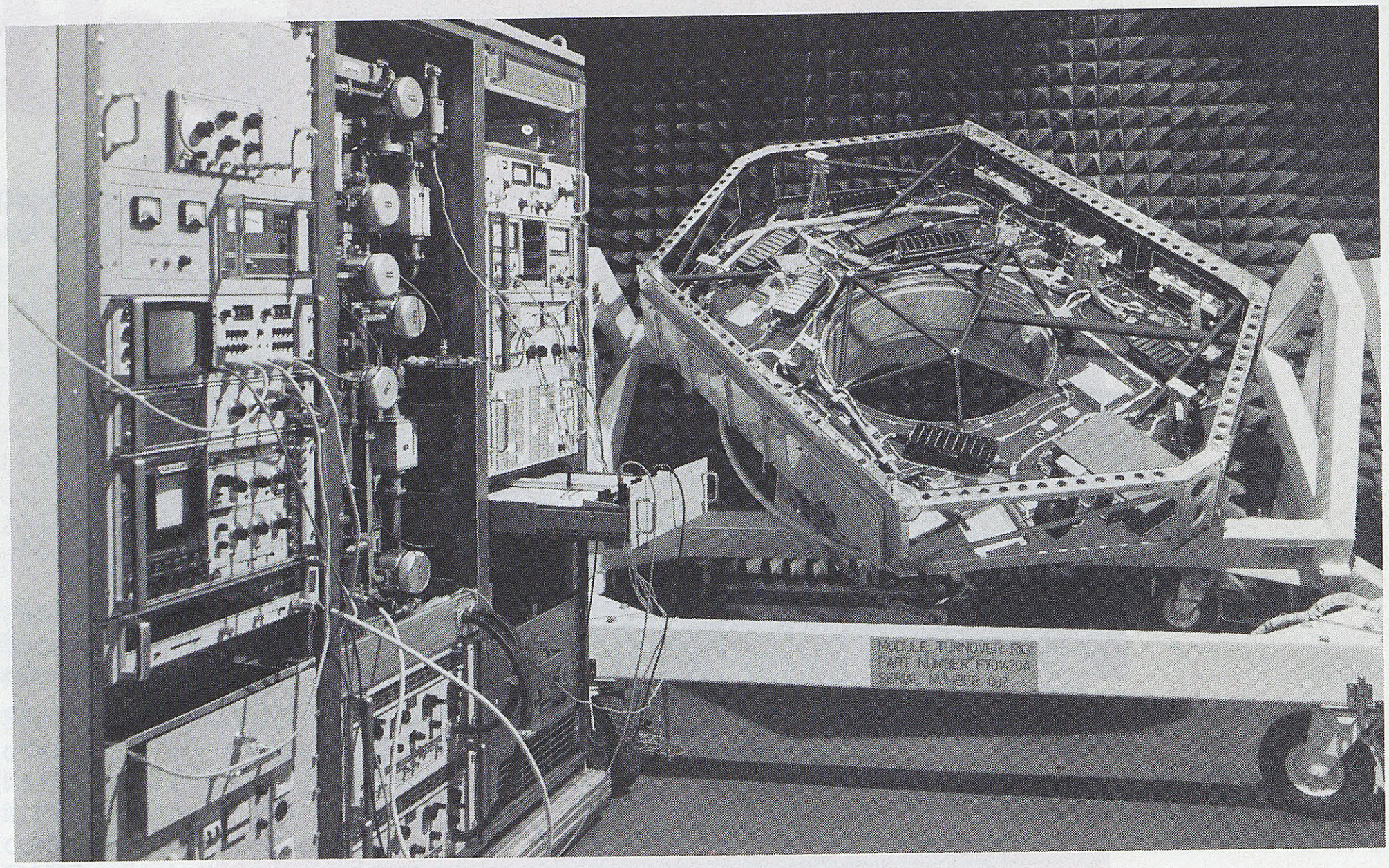

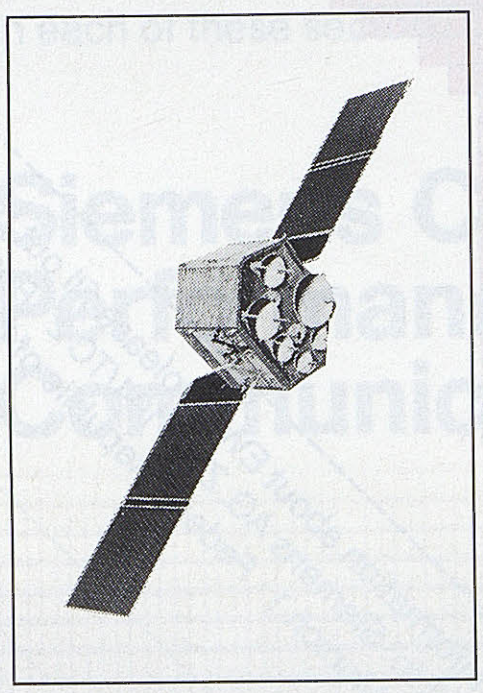

The OTS, launched on May 11, 1978, has been designed to prove in orbit the reliability of all on-board equipment and to test the transmission and access techniques in the 11 and 14 GHz ranges that are envisaged for use in the ECS satellite.

A group of European companies, headed by AEG-TELEFUNKEN developed and manufactured the transponder – the communications payload of the satellite.

Other AEG-TELEFUNKEN contributions to this pioneering effort were the microwave integrated circuits, a special TWT with a useful life of 7 years, and the fold-out solar cells with a total power of 830 watts.
Please ask for details of particular interest to you.

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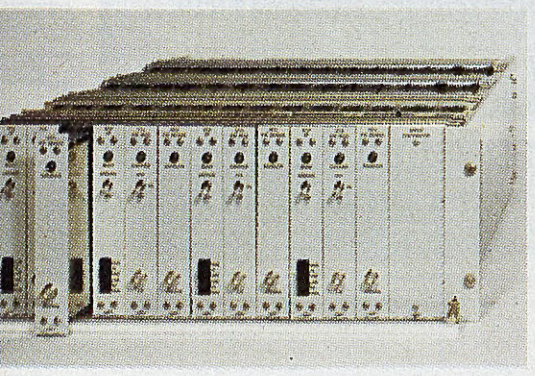
Communications satellite systems of AEG-TELEFUNKEN



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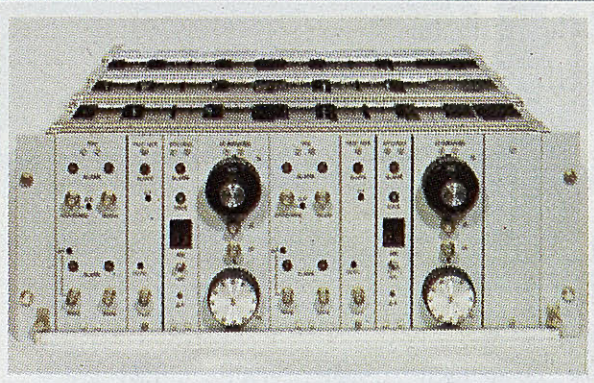

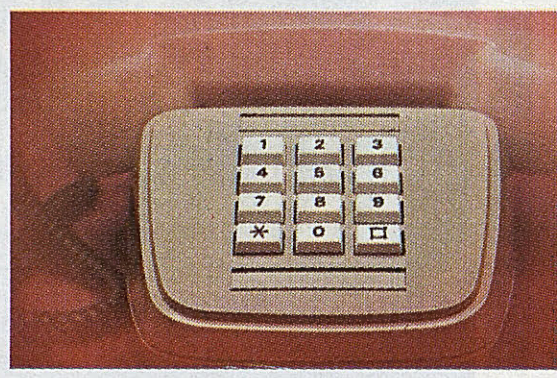

Satellite communications via SCPC

Philips RS100 and RS200 communications systems are based on Single Channel Per Carrier (SCPC) techniques provide an economic and highly efficient approach to voice and data transmission via satellite.

Inherently flexible and reliable, they are ideally suited for application in domestic and regional rural, small and medium trunk telephony facilities.

High quality digital transmission through 32 kbit/sec DCDM (Digitally Controlled Delta Modulation) with 4-phase PSK is provided by the RS100, while a totally analogue facility, using FM with 2 to 1 companding and threshold extension demodulation, is offered by the RS200.

Remarkably compact – four complete channel units can be contained in a single standard 19" shelf – both systems incorporate VOX (Voice Operated Carrier), echo suppressor and E/M signalling facilities; a full common-equipment expansion capability of speech channels, and a wide flexibility in transmit and receive frequency channel selecion and channel spacing (22,5 to 60kHz.).

Besides supplying advanced SCPC equipment such as the RS100 and RS200, Philips also design, supply and install complete earth stations.

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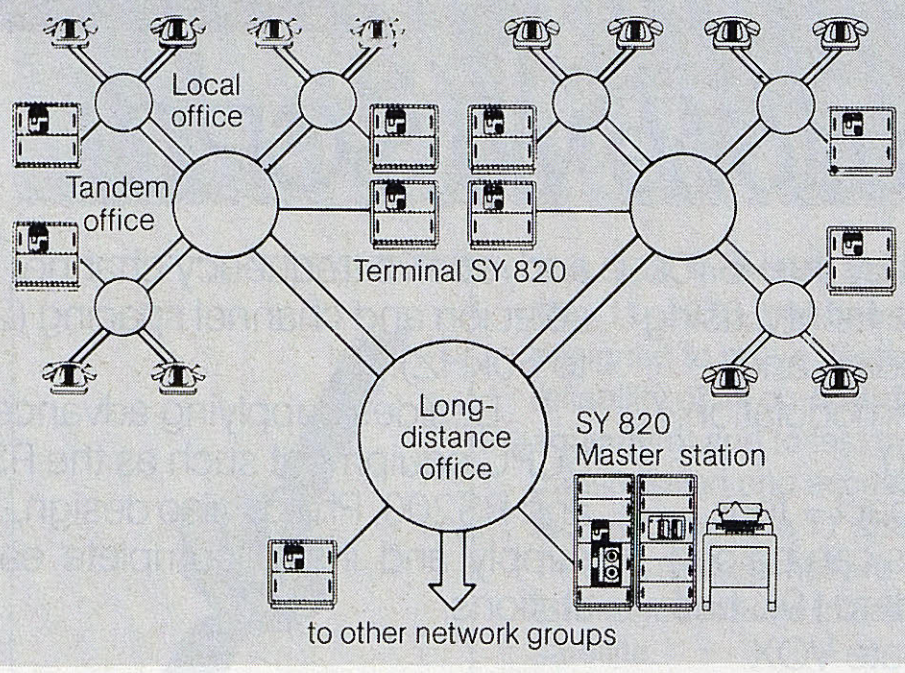
You and your customers get more out of your telephone network if upgraded with the advanced Autophon System 820.

As a versatile management information and monitoring system for telephone networks, the SY 820 of Autophon upgrades existing electro-mechanical exchanges to features and services hitherto confined to SPC offices.

The SY 820 brings you, singly or combined, the following features:

- ☐ electronic call-charge accounting (to replace electromechanical counters),
- ☐ detailled billing or automatic message accounting,
- ☐ centralised traffic flow measurement,
- ☐ centralised supervision of auxiliary equipment in remote offices.

System 820 can be custom designed for any telephone network



Autophon's SY 820 is based on the following design principles:

- ☐ microprocessor-controlled, self-contained out-stations transmit preprocessed data to the master station,
- ☐ integral modularity enables using the same hardware in outstations both large and small, and in the master station,
- ☐ systematic application of microcontrollers and microprocessors enhances system flexibility,
- ☐ data output is explanatory text in your national language.

Speak to Autophon when you need to give or receive information, if you want to communicate verbally or visually, when you need the right connection with or without wiring, when you need to give warning, supervise, or be ready for action.

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AUTOPHON

SCIENCE/SCOPE

Indonesia will link its many islands with a new generation of Palapa communications satellites. The Palapa B spacecraft -- which will provide voice, video, telephone, and high-speed data service -- will be more than twice as big and four times as powerful as those launched in 1976 and 1977. Each will have 24 transponders and 10-watt power output. The increased capability reduces the expense of extended coverage to small rural terminals in remote areas. Hughes, under contract to Perumtel, Indonesia's government-owned telecommunications company, is building two satellites and associated equipment to augment certain ground stations. Although the launch vehicles still must be chosen, the craft are compatible with NASA's Space Shuttle or Delta or Ariane rockets.

A one-of-a-kind test facility will prepare NASA's Project Galileo probe for the rigors of descent into Jupiter's atmosphere in the late 1980s. The six-foot diameter chamber, constructed by Southwest Research Institute for Hughes, simulates a helium atmosphere with the temperature and pressure extremes that the Hughes-built probe will encounter during its plunge through the Jovian sky. Test objects initially are exposed to a vacuum and temperatures of -200°F. Then, within 55 minutes, the pressure is increased to 235 pounds per square inch and the temperature is raised to 240°F. The Galileo project is managed by NASA's Ames Research Center.

The Calypso, undersea explorer Jacques Cousteau's vessel known worldwide for its oceanographic explorations and discoveries, is now using the communications services of the Marisat satellite network. The network's three satellites were built by Hughes under contract to a consortium led by Comsat General Corporation to provide telecommunications services for the U.S. Navy and commercial maritime industry. More than 300 terminals are installed on cargo ships, tankers, luxury liners, seismic ships, and off-shore drilling platforms around the world.

Solar cells, those blue wafers of silicon and metal that power spacecraft by converting sunlight into electricity, are performing better than ever -- and at less relative cost. In 1963, the typical cells built for Syncom I measured 2 square centimeters and generated 20 milliwatts of power. Modern cells developed by Spectrolab, a Hughes subsidiary, measure 16 square centimeters and generate 320 milliwatts of power. Furthermore, despite inflation, the cost per watt is vastly reduced. These new cells will provide increased power to the Anik C and Satellite Business Systems spacecraft.

In a model of international cooperation, SPAR Aerospace Limited of Canada and Hughes are pooling their resources to build two Anik D spacecraft to provide television and telecommunications services for Canada. Each satellite, the first of which is set for launch in 1982, will have 24 channels and operate in the 6/4 GHz frequency band. SPAR will build the spacecraft under contract to Telesat Canada. Hughes, the largest subcontractor, is responsible for the spacecraft bus, propulsion systems, and solar panels. Hughes previously built three Anik A satellites and is now constructing three Anik C craft, for which SPAR is the largest subcontractor.

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Hasler Telecommunications

With the Hasler SP 300 you don't need to dial to set up a call. This saves a tremendous amount of non-productive time in your telex exchange registers.

We all know what goes on during dialing with conventional telex equipment. Every subscriber selects his own rhythm. And often too slowly. Occasionally, wrong numbers are dialed. All this prevents your telex exchange from operating really at peak efficiency.
With the Teleprinter Hasler SP 300 all this is different. The caller first dials into the memory. Now he can check at his own convenience if the number selected is correct. If this is so, he may release the selection procedure, which is now performed by the memory, at optimum speed.
However, in case of the fifteen most frequent telex partners the procedure is even simpler. These numbers are dialed by the abbreviated dialing memory.

If a number is busy, the dialing procedure is repeated at the simple touch of a key, the repeat key.
Of course, much more could be said about the Teleprinter Hasler SP 300. For instance, how easy it is to maintain spares and service despite its great versatility. Or, that the SP 300 can be switched over from Latin characters to Arabic and Cyrillic fonts. Not to mention its flexible word processing capabilities, the automatic carrier return and the automatic answering feature.
All this information and much more is available to you, down to the smallest detail.
Please send for our detailed literature.

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Belpstrasse 23, CH-3000 Berne 14
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Hasler

649 STR

More and more people need a small, compact call simulator suitable for every kind of exchange and all types of circuit. And more and more people are looking for a call simulator which also cuts costs, saves time and personnel and is 100% reliable. So STR went ahead and made one.

Until now there were only two kinds of call simulator on the market: the traditional electromechanical single-test apparatus, which admittedly is fairly cheap but can be used for only one or two types of circuit; and the newer equipment with minicomputer control, which is certainly versatile but takes up a lot of room and is expensive. Neither system is designed for universal testing.

But now, at long last, there is a third type of call simulator on the market: the Universal Call Simulator (UCS) with microprocessor control. It is small (103x100x40 cm), handy and mobile – and really universal in application.

Universal means greater flexibility
The UCS is more than just another improvement in conventional technology – it introduces a completely new generation of automatic call test equipment. It functions perfectly in all types of exchange and can handle every kind of circuit. Not only in new installations and handover testing but also later during regular maintenance routines (especially where no integrated test facilities exist). It can test up to 14 trunk or line circuits and offers in addition a combination of advantages that is unique.

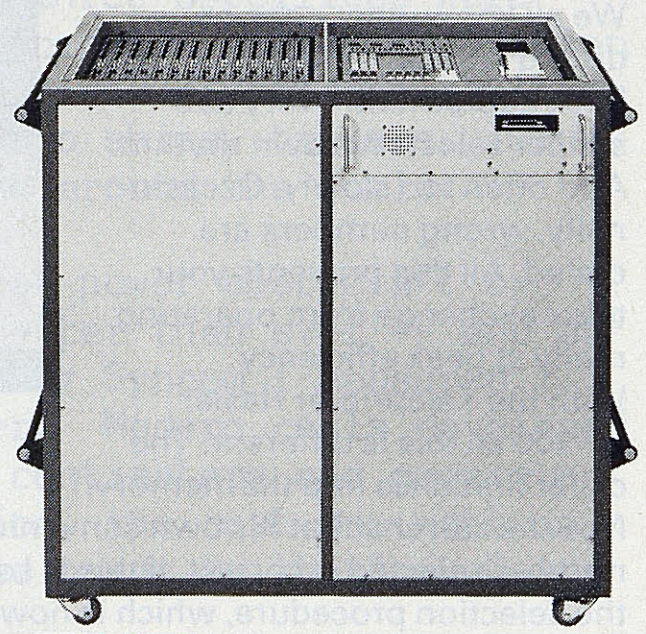
Lower costs – starting with the purchase price
The UCS not only costs considerably less than an installation with minicomputer control (and very often with far more capacity than you can use) – it is even less expensive, on the basis of comparable performance, than conventional electromechanical test equipment.

Save time and personnel
Compared with existing test methods, the UCS needs considerably less operating time. And since, in contrast to installations with minicomputer control, its programming language is extremely simple, training takes only a few days instead of several months. And finally: for the same volume of work the usual squad of three or four men can be replaced by one single technician.

Easier work
Since the UCS is controlled by microprocessor it has an electronic memory. This means that test programmes and statistical test results can be automatically recorded on cassettes.

Real reliability
The UCS is a true product of Swiss engineering skill – its reliability is proverbial. The new technology built into it ensures that it can satisfy extremely stringent operating requirements and thus guarantee that modern switching systems can be tested with maximum reliability and accuracy.

UCS
The new-generation call simulator – small, handy and universal.



Full information on the new UCS

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Solid-state FM transmitters for up to 3 kW

Rohde & Schwarz's new, solid-state FM broadcast transmitters for output powers of 50 and 500 W, 1 kW, 1.5 and 3 kW, are now in batch production.

Customized design
The building-block principle doesn't only lead to rationalized and costsaving production, it also makes the transmitters flexible when it comes to adapting them to different requirements: passive or n+1 standby, incorporation of extra R&S units like stereocoders, FM demodulators or relay receivers. Building-block design also simplifies servicing and the stocking of spares.

High reliability
The new transmitters don't have any wear-and-tear parts like tubes or blowers, and what's more the system modules check themselves out and shut down automatically if a fault occurs. A completely new kind of convection cooling with a funnel effect ensures long useful life of the power transistors.

Low power consumption
Efficiency is very high and stays optimal when the output power is reduced.

Easy installation and simple servicing
These transmitters can be set up and put into use by the operator. Measurements and repairs are possible while they are running, and the replacement of a plug-in doesn't call for any new lining up.

Ask for detailed information about
Solid-state FM transmitters

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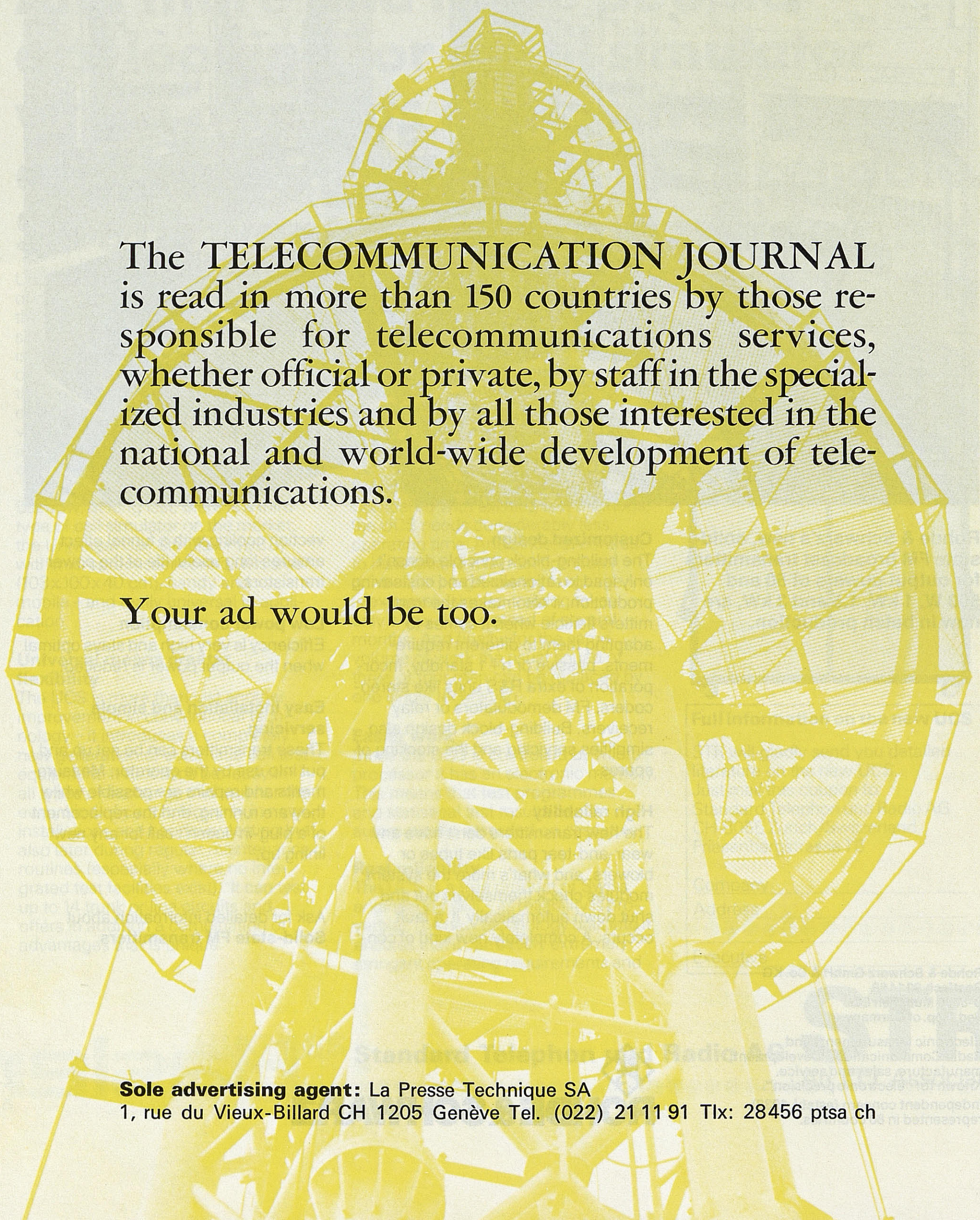

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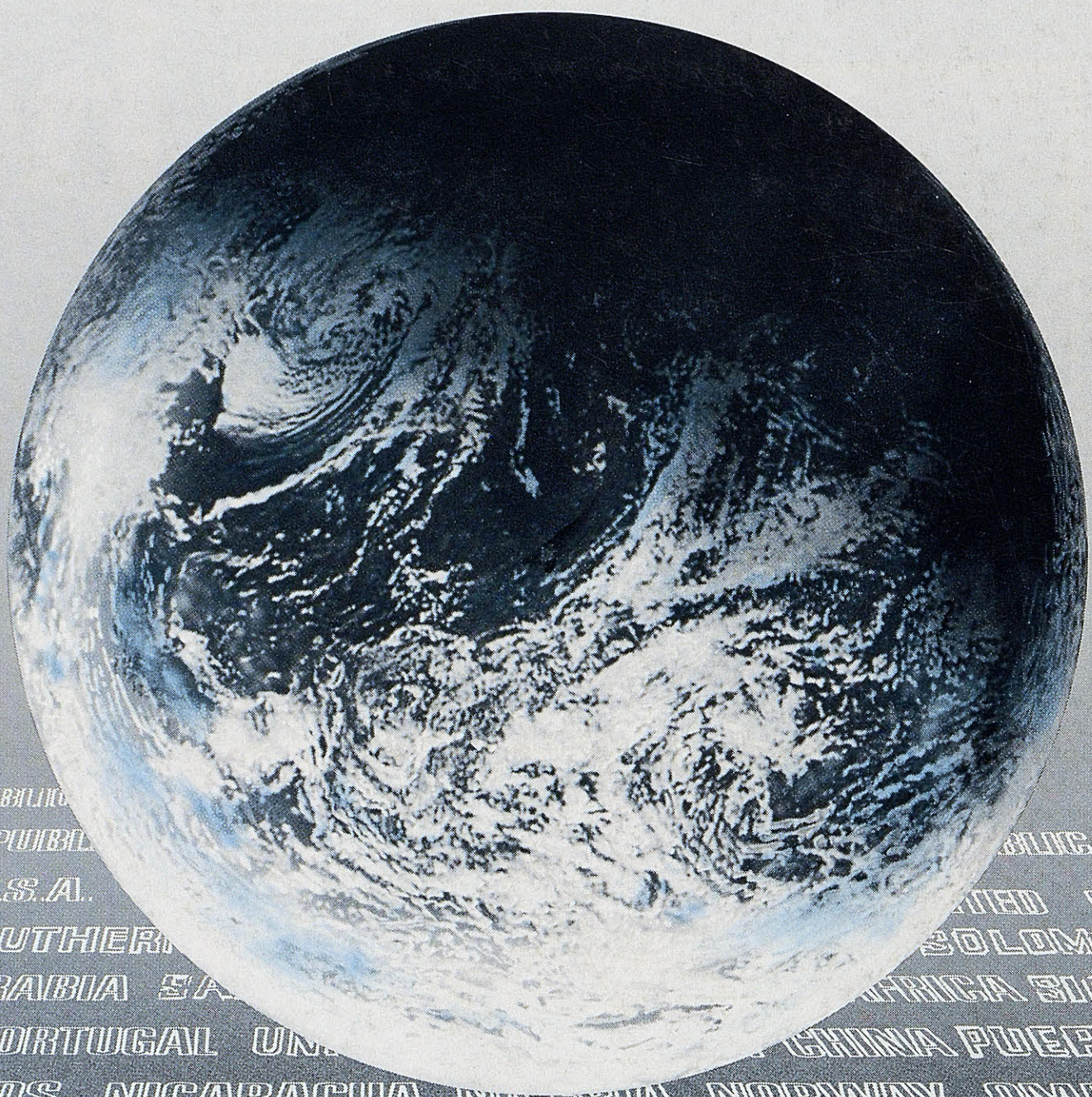

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